THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. BERLY'S),

1908 EDITION

NEARLY READY.

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ELECTRIC COAL-CUTTING IN AUSTRALIAN COAL MINES.

A FEW weeks ago we referred to the threatened strike of the miners at the Northern Collieries in Australia, who complained that the machines were in a dangerous part of the mine where gas was present, and refused to work them, whereupon the owners stated that if the machines could not be worked, it was not worth while to keep the mines open, and they closed them down.

A committee was then appointed to go into the question, and an interim report has just been issued, a copy of which lies before us; the reading of this appears only further to justify what we have so many times said in speaking of colliery electrical machinery, that it is not electricity that is at fault, but the unaccountable way in which it is—so to speak—"managed." In the case of the Hebburn Colliery, where the trouble primarily originated, we must at the least say that in our opinion the management has been both unsatisfactory and "weak," as, if all the report says be true, the person who is styled the "mine electrician" ought to have been relieved of his duties, if — and we put this question without prejudice—he had any right to call himself an "electrician"—by which term we mean one who has had a training in electrical engineering.

At any rate, it was for the manager, since by law he holds the responsibility, to see that his instructions were carried out, and if the "electrician" did not comply, then he ought to have lost no time in engaging someone who would do so. Thus, in all probability a lot of trouble, and all this inquiry, with its report and special rules, which anyone with ordinary common sense would carry out without its being required that they should be made law, would have been avoided, and the coal mining industry would not have been saddled with rules and regulations, many of which are unnecessary to the common-sense miner, while others are more vexatious than useful. The report states:—

> Having considered the whole of the evidence, in conjunction with the large amount of additional information which we have obtained elsewhere, and having carried out a number of inspections of other collieries, to which fuller reference will be made in our final report, and having also had reproduced before us experimentally at the Ultimo power house, occurrences similar to those which according to the evidence, have taken place in the Hebburn colliery, we have arrived at the following conclusions:—
>
> 1. The appearance of fire-damp upon a number of occasions, in the main dip, and at least twice in serious quantities in Savage's section, fully establishes the necessity for taking every care in connection with the electrical equipment, to avoid any condition which may give rise to an open flame, or other possible cause of gas ignition.
>
> 2. A considerable number of burn-outs have taken place in the Hebburn colliery.
>
> 3. These burn-outs are sufficiently startling in their appearance to justify genuine alarm on the part of the miners, even where naked lights are allowed, but more particularly where safety lamps are in use.
>
> 4. Owing apparently to the presence of fire-damp in dangerous

proportions at Hebburn being regarded by the management as improbable, prompt and effective measures to overcome the trouble were not taken by those immediately in charge of the apparatus.

5. The matter of the use of electricity in this mine will not be on a satisfactory basis until a complete set of regulations governing the installation, operation, and testing of every portion of the equipment has been adopted, and is enforced. This will involve the obtaining of some additional testing apparatus by the management.

It is important to note that (2) and (3) refer to "burn-outs," as if they were a necessary evil consequent upon the use of electricity. Not a word is said as to why the "burn-outs occurred, nor is any suggestion made as to their prevention. But the next paragraph makes really sad reading, and will explain our criticism of the so-called "electrician." "As will be indicated by the second and third conclusions above, we were favourably impressed by the sincerity generally of the miners in their evidence as to the number and nature of the burn-outs. In justice to the management, we are also glad to say that the matters to which we have taken exception at Hebburn are not the result of the installing of inferior apparatus in order to save expense. On the contrary, the equipment is generally of a high class, and the low-pressure current was deliberately adopted by Mr. Harle, with a full knowledge of the consequent heavy additional cost of cables, so as to minimise the risk of serious shocks to the employés.

We could not, however, escape the conclusion that the policy of the management in these respects was to a considerable extent defeated by the attitude of the mine electrician, who, in giving evidence, treated the question of the existence of gas in the mine as a fit subject for jocularity. As might have been anticipated under these circumstances, steps do not appear to have been taken to thoroughly sift every source of trouble in connection with the electrical installation, so as to provide in every reasonable way against recurrence.

The electrician admitted that he had received instructions from the manager to conform to the requirements of the draft regulations drawn up by the Mines Department, but that he had not done so. He said that he was prepared to observe them as soon as they were legalised. These admissions, taken with other evidence obtained elsewhere, have impressed upon the members of the committee the grave necessity for the establishment of proper regulations, with the full force of law, at the earliest possible date.

The italics are ours, and any man whose evidence could give rise to such a report must have been, to say the least, misguided.

"He said he was prepared to observe them as soon as they were legalised." Surely after such an admission as this, one might ask whether it was not time the law removed the responsibility of mechanical and electrical matters from the colliery manager, and insisted upon men being appointed who, by proper training, experience and examination, if necessary, were fitted to hold such a post. One such rule would be worth all the rest of the special rules put together, and what is more, there would be less of this whining about the danger of electricity in coal mines, and such a person as the "mine electrician" above mentioned would find his proper level, with some one to tell him what to do and see that he did it!

A long list of special rules then follows, which we need not repeat here, even if space allowed; though they may be ornamental, they are certainly not useful, as the following, which is the last, will show:—

1. Fuses shall not be replaced by anyone except the electrician, the deputy machine-man, or other competent person appointed by the manager. A record of each instance of the main circuit-breaker opening shall be made in a book at the mine by the engineman in charge; and the number of fuses replaced, and of openings of the main circuit-breaker during the week, shall be stated in the weekly report, forwarded to the district inspector of collieries.

How will these weekly reports interest the inspector? And how will he deal with them? These are interesting questions which we are inclined to think he will answer, not with a "burn-out," but with a "burn-up."

Electricity Abroad.

Those of our readers who take an interest in the foreign affairs of electrical engineering trade and industry will find a plentiful supply of food in the following pages of this issue. For those who think of Japan there is a short but interesting contribution on the cost of living in that country, written by one who has had practical experience up to date in the matter of which he writes. On another page a further contribution occurs relating to the position and doings of electrical companies in Germany. Mr. Emile Guarini, Professor at the Escuela de Artes y Oficios at Lima, deals with electrical affairs in Peru, into which he has naturally made a more or less exhaustive inquiry since he went from Brussels to take up his position there a couple of years ago. The vast opportunities for electrical trading in the Argentine in the future are discussed, and the strong position of Germany in that particular market is clearly pointed out—the main reason for that strength being the enterprise shown in securing concessions, which very important work has been rendered possible chiefly by the generous support of German financiers and investors. Undertakings, formerly British-owned, were purchased by German interests with a view to electrification, and so they have been allowed to slip through our fingers, together with a great deal of the trade which should have been ours now had not the concessions been parted with for a German mess of pottage. Some trade statistics concerning Brazil will also interest those who are inclined to study them closely.

In addition to the foregoing, we are further enabled to publish a valuable table of statistics received from the Engineering Society of Siam, concerning a number of electric light, power and tramway systems in Far Eastern countries. This, no doubt, the trade will want to preserve, together with the similar particulars of South African and Australian undertakings, which have appeared in these pages at different dates.

Inspection of Residence Lighting.

Our contemporary, the *Illuminating Engineer* of America, frequently contains valuable hints to engineers connected with electricity supply undertakings, and in the December issue a particularly suggestive article on residence lighting and the lighting companies is included. It is pointed out that as regards numbers, residents furnish a large proportion of the customers of central stations, and the goodwill of this large *clientèle* is of great importance.

This importance arises not merely from the intrinsic value of the lamps connected per installation, which may, perhaps, be small, but also on account of the fact that nearly every man who is in the position of using electric light in his house is probably connected in some way with a business which may very profitably use electricity, either for lighting or for motive power. To cultivate the goodwill of such a man is, therefore, a prime necessity.

The article also points out that a little attention in the way of making personal friends of customers may go a long way towards the making or marring of the larger interests of the supply company, inasmuch as there is no telling what influence the man, whose personal lighting bill is only a few shillings a month, may have with interests that are

powerful either commercially or politically. As there is a clause in every lighting company's agreement with its consumers giving the right to inspect its property on the customer's premises, an *entrée* is given to an inspector which would in many cases be denied to an ordinary agent or salesman. A gentlemanly inspector would have no difficulty in being received by the mistress or master of the house, and of personally examining the entire lighting installation. This could be made an opportunity by a capable man of making suggestions for ways of improving the quality of the light and of cutting down the expense.

The days are past in England when it was considered inadvisable to suggest any reduction of energy consumption by a consumer, as every station engineer is aware of the fact that electric light to be successful must be reduced to its lowest economic basis. At the same time, while theoretical assent is given to this, it would, perhaps, be difficult to find many supply systems where any systematic attention is paid to the consumer other than the visit of the meter reader, or the account collector. In other words, so long as the owner of the installation remains passably quiet no notice is taken of him ; it is only the unruly ones who get the best attention. This is, of course, antagonistic to the principles of fair business dealing. The best customer should get the best attention, and it would seem worth the while of every supply company to institute a system of friendly inspection of every customer's premises for the purpose of suggesting improvements. The increased cost, which would not be negligible, would be fully met by the satisfaction and consequent increase of business, resulting from the opinion on the part of consumers that their interests were being diligently considered.

The Protection of Steam Pipes from Accident.

At one time there were no steam pipes. Working cylinders were placed directly upon the boilers, but time effected a separation and brought into being the steam pipe, and this was square in cross-section, as befitted a vessel exposed only to atmospheric pressure.

Writing in the *Engineering Magazine*, Mr. Arthur Herschmann advocates special precautions against accidents to steam pipes. We all know the isolating valve devised to shut off a boiler automatically in case of failure, and when we hear the rolling of the ball inside the casing, we may be pardoned for nervousness, for who knows what that ball would wreck when acting under pressure from one side as it was impelled to its seating ? Surely something would be smashed.

The absolute failure of a pipe might very quickly empty a boiler of steam, and might bring about far more water damage than steam damage. Nor is escaping steam only to be feared because it is hot ; a room may become so filled with cool steam or vapour as to be suffocating, though everyone familiar with steam work knows that a man can live in an atmosphere of cool steam in which a lamp cannot burn for lack of oxygen, for a man will outlive a lamp in an excess either of moisture or of carbonic acid.

Boiler rooms may, says the author, still be found where men have to crawl through tight places to reach certain valves, and there is more than one ring main or parallel main in Great Britain, where the valve spindles extend up into a grid floor gallery just over the pipes, so that the shutting of any valve involves passing through the escaping steam. This is, of course, quite appropriate to the ring-main folly. But in the best of designs, if a main pipe bursts and lets out the contents of all boilers, what chance of safety is there ? A boiler house is assumed to be 60 ft. by 40 ft. by 20 ft. high. It has 29,000 ft. of free space after deducting the volume of the boilers. A header supply pipe bursts at 150 lb. pressure, and the velocity of outflow is 1,478 ft. per second of expanded steam through a 5-in. pipe. This volume of steam will fill the whole room in 30 seconds. Obviously there ought to be reasonable facilities for men to escape in a direction towards air inlets. Every boiler room ought to have air inlets to supply air to the furnaces, and these should be near each boiler, to prevent sweeping draughts. A far-distant door at the end of a long house is liable to set up dust-producing draughts. In a high boiler house with free air entry below, the escape of steam may, perhaps, do little harm. Steam is very light, and tends upwards. Escape should be effected at low levels.

The author advocates automatic isolating valves, but it is not to be thought that it is easy to arrange for these to act properly in a pipe, the flow in which jumps suddenly from 90 to 900 ft. per second. Such a valve might be too responsive, and act under the transmitted impulses of the engine. Yet such a valve ought to close with even a comparatively slight pipe break. It must not be too heavy, and must be kept "off" by artificial means. Gravity and the assisting ejector action of the flowing steam are thought to be reliable principles of action on which to depend.

Automatic valves have, it is stated, been compulsory in France since 1886, when the explosions of Eurville and Marnaval liberated steam that killed 30 and seriously injured 60 people. Several valves are illustrated, some of which depend upon the support of the valve disk by means of a piston in a cylinder, any difference of pressure causing the no longer steam-supported valve to move down upon its seat. The valve of the Foster Engineering Co. appears good, but it is large and obviously costly. All those illustrated are of American origin. It might be suggested that definite tests of such valves by some authoritative committee would do much to give users faith in them if they passed the tests satisfactorily. But it need hardly be pointed out that there is among engineers a strong feeling against a multiplicity of valves, just as there are objections to the ring main and other attempts to combat by duplication the evils of bad workmanship. Steam pipes, valve bodies and junction pieces ought to be made of material equal to boiler material, and erected with equal attention to the stresses due to movement from any cause.

At one period of the electrical generation of power it was the fashion to multiply indefinitely not only generating sets but steam pipes, the assumption being that boilers and steam pipes were as likely to break down as were the engines and generators. Better steam practice has since prevailed, and the aim is to shorten pipes to a minimum, and not to strive after complex pipe arrangements which provide for driving any part of the generating plant from any part of the boiler plant. All this diminishes the call for valves of the automatic shut-off type described.

The Future of Coal Prices.

In a recent issue of our contemporary, the *Iron and Coal Trades Review*, attention is drawn in the form of a leader to the probable future of coal considered from a financial standpoint. The conclusion arrived at may be summarised in the following excerpt from the article.

"Under the stress of an over-supply of coal in the United Kingdom and the decline of exports, matters in the coal trade may soon reach a climax ; in any case, it would seem that a considerable fall in price is inevitable from the simple fact that British coal prices have risen out of proportion to all others abroad, although industrial activity on the Continent has been relatively greater. Possibly the reaction abroad will be commensurate in this, but in such a case our exports of coal will be affected the more, and there will be the greater need to arrest the needless sacrifice of profits by a futile reduction of price." The steps of logic by which this result was obtained may be summarised as follows.

The coal trade of 1907 has proved that when coal is in demand buyers are not deterred by high prices from purchasing the quantities they require. British collieries have

it in their power to maintain a fair rate of dividend until their superior quality of steam, gas and anthracite coal has given out. As a good and regular return on capital must be maintained, and as this depends on the steady maintenance of a reasonable level of price, more especially on exported coal, competition in the future by cutting of rates should be avoided by British coal-owners. It is incidentally mentioned that the magnitude of the investments in collieries induce the result that few branches of enterprise more cripple the spending power of the people in this country than the coal industry in those years when dividends are either poor or rendered non-existent. For this reason it is urged that it is to the best interests of the country that some sort of agreement should be made amongst the colliery companies to maintain what is deemed a fair price for coals.

While in general agreement with the tenour of the leader, it may be well to look for a few moments at the case as it appears to those concerned in industries depending on the price of coal for their success. The scarcity of coal in the United Kingdom during the past year, and the inflated prices charged to consumers, is a matter too well within the recollection of our readers, more especially the managers of electricity supply concerns, to call for further comment. The inflated price has been directly due to export operations conducted by the coal-owners. They were assisted in the matter by what our contemporary calls "the widely-heralded coal requirements of Germany," and the mistaken and prevalent impression that the output there was, if not actually falling off, at least unable to maintain its level owing to scarcity of labour and railway wagons. The result has been in this country that in industrial districts a state of acute stress has been set up, and labour in the country has severely suffered. If there is to be a protraction of the present high rates of coal by any artificial means, such as an agreement to maintain prices among colliery companies, many of our important industries will be hard hit in the coming year.

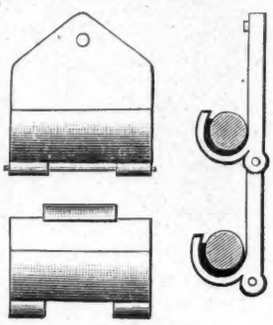
We think our contemporary over-estimates the importance of coal industries in circulating money in Great Britain, and account should be taken of other great enterprises, not the least of which are those concerned in the supply of electric light and power, in which much capital is invested, and whose profits have in recent times been seriously crippled by high prices charged for coals. From the point of view of the interior welfare of industry in England, it is to be hoped that the natural operation of competition ensuing on a decreased export, will bring down coal prices to something like their normal state, and that the doctrine that decline in consumption will not be arrested by a reduction in price, nor will low prices stimulate trade, may be proved in practice to be untenable.

The German Electrical Trade Situation.

A statement has been made in administrative circles of the Allgemeine Electricity Co. in regard to the present condition of business and the future development of the German electrical industry in general, and of the Allgemeine Co. in particular. The statement does not deny that the retrogression in trade is reacting upon the electrical engineering industry, and to a greater extent in Germany than abroad. Nevertheless, such a weakening, in accordance with the opinion expressed in high banking circles, is to be regarded as an indispensable factor in the return of normal conditions in the money market. The Allgemeine Co. embarked upon its current financial year with a large quantity of orders, but it seems impossible at present to express any idea as to the ultimate results, as the latter depend upon the further course of the development of trade. The American electrical crisis has not had any influence upon the large German electrical works, not excepting the Allgemeine Co., whose connection with the General Electric Co., of Schenectady, can only be mentioned as having been prosperous down to the present time.

SUSPENSION OF CABLES FOR RAILWAY WORK AND SIMILAR PURPOSES.

There are one or two points in connection with the proper handling of cables intended to carry large quantities of energy, either at high or low pressure, which are worth considering, more particularly in connection with railway electrification and similar work. One of the chief things to remember in designing a means of changing over from steam to electric traction is that the work must be accomplished as cheaply as possible, having regard to efficiency and safety, hence every available economy in laying the feeding cables must be practised. Many railways have their lines flanked by substantial retaining walls, bridge structures and the like, and where this is the case the form of hanger for cables indicated in the accompanying sketch may be found of advantage. It consists of a simple iron casting furnished at the top with a bolt hole, which is passed over a rag bolt fixed into the wall and is secured loosely by means of a nut. At the lower edge of the hanger are provided hinge



Cable Hanger.

joints for the purpose of suspending any further hangers, where cables are laid in multiple past any point of suspension. These lower hangers have, in place of the provision for the bolt hole, the complementary part of the hinge joint; and a rod passed through the common axis of these hinge parts secures the lower hanger to the upper. This can be repeated until provision has been made for the required number of cables, and the apparatus provides a simple and strong means of suspension, forming a cheap substitute for the system of brackets supporting troughing which is sometimes used.

The chief difficulty that is now found with this form of suspension is, in the case of heavy lead-covered cables, that the weight and sag of the cable gradually compresses the lead at the point of support, and if means are not taken to prevent accident, this nipping action will work the lead away at the tip of the hanger and moisture will penetrate to the cable. In order to avoid this trouble, a thick layer of felt should be placed between the hanger and the cable, as indicated on the sketch in black.

In the bracket and trough method of carrying cables along retaining walls it is customary to fill up the trough with bitumen in order to protect the cable against accidental pin-holes. In the hanger suspension this precaution is quite as easily obtained by painting the lead sheath with two coats of tar or good oil paint. In some cases this latter method has been combined with a means for indicating the nature of the cable. For example, red paint has been used for high-tension cable and blue for low tension. Although this is a minor point in construction, yet we think it might be recommended to engineers in any situation where heavy cable has to be carried in a cheap and safe manner.

Electrolytic Corrosion in Reinforced Concrete.—Commenting upon the value of reinforced concrete as regards economy of material and protection of the steel from ordinary corrosive influences, *Indian Engineering* points out that it is unfortunately not proof against electrolytic corrosion by stray currents, and advocates the efficient bonding and earthing of the metal parts, wherever stray currents are likely to be met with.

VERTICAL-SHAFT MOTORS.

The recent article and correspondence on ball bearings for electric motors have elicited from the Electrotechnische Industrie, of Slikkerveer, Holland, a communication relating to their motors with vertical shafts, of which they make a speciality. As we rarely hear anything of Dutch electrical manufactures, special interest attaches to the accompanying views, which are intended to illustrate more particularly the arrangement of the bearings.

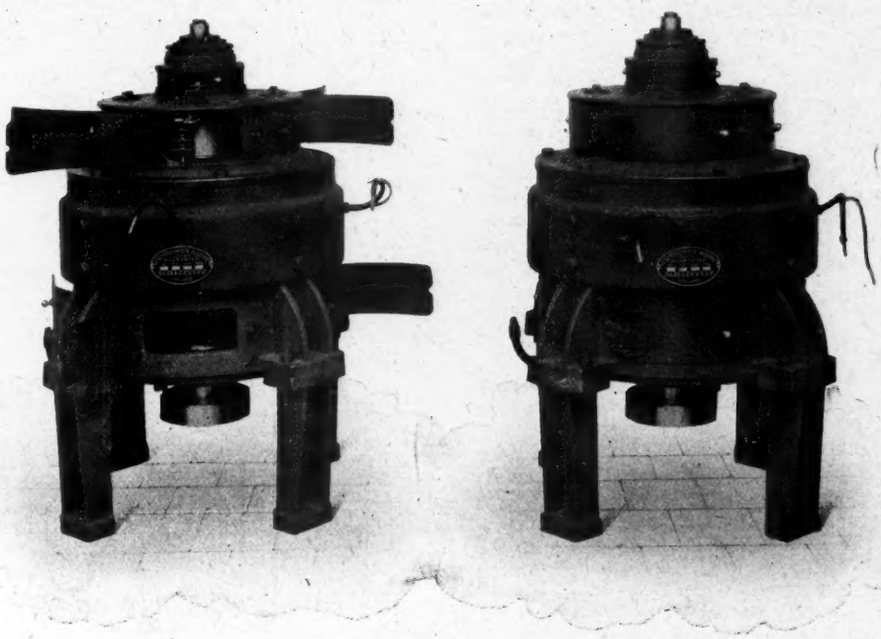


Fig. 1.—10-h.p. d.c. Motor with Doors Open and Closed.

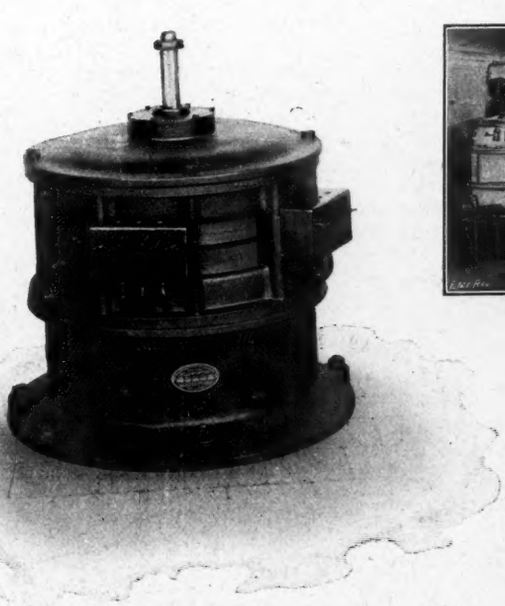


Fig. 2.—15-h.p. Three-Phase Motor.

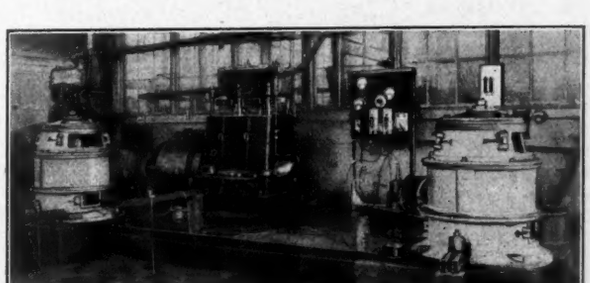


Fig. 3.—Testing Motors Upright.

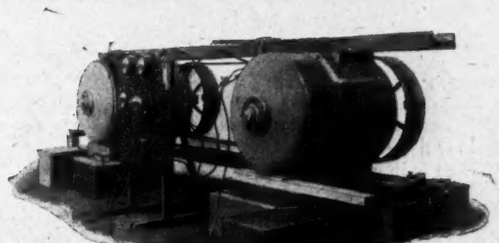


Fig. 4.—Testing Motors on their Sides.

Fig. 1 shows a 10-h.p. d.c. motor provided with a coupling underneath, and carried on pedestals to keep the coupling above the floor; this motor runs at 485 r.p.m. and drives a centrifugal pump. Doors provide access to both bearings and to the commutator. Fig. 2 represents a 15-h.p. three-phase motor, arranged with an upward-extended shaft for driving a centrifugal drier by pulley and belt, the motor running at 1,450 r.p.m.

The details of the arrangement of the bearings are shown in the drawings, figs. 5, 6 and 7. It will be seen that, in the case of the 15-h.p. motor (fig. 6), the upper bearing consists simply of a guide running in an oil bath, so arranged that the oil cannot gain access to the interior of the motor. The footstep bearing is both guide and thrust, carrying the whole of the weight of the rotor, and the slip-rings are situated just above it. In fig. 5, showing the bearings of the 10-h.p. motor, the armature is suspended from the upper compound ball bearing, while the lower bearing is only a guide running in oil and, so to speak, turned inside out to prevent leakage of the oil. This construction has proved satisfactory for speeds up to 1,500 r.p.m., and there is no reason to suppose that equally good results would not be obtained if the lower bearing also were of the ball type. Fig. 7 shows the bearings of a 60-h.p. motor for driving a centrifugal pump at 900 r.p.m. A construction somewhat resembling fig. 5 is used for a swing bridge, two motors of 30 h.p. each being suspended under the bridge; in this case the ball bearing is at the foot, for convenience of access, and the upper guide is a simple

bearing lubricated with grease through a long passage drilled in the end plate.

Two of the methods adopted for testing vertical shaft motors are shown in figs. 3 and 4. The former relates to two 30-H.P. motors connected by a belt beneath them, and the latter to two motors of the same output being tested on their side in the same way.

COST OF LIVING IN JAPAN.*

(FROM A CORRESPONDENT.)

IN dealing with the question of the expenses of living, it has to be borne in mind that in the East the personal equation plays a very prominent part.

If a man is a decent fellow, then his employers are regarded as good people; if he is in any way below par, then his employers' interests are apt to suffer, and very often a man has to go to expenses which personally he would gladly forego, but which it is to his employers' interest to incur. These expenses are of such a nature that it is extremely difficult to say to whom they should be allocated, and they are invariably borne by the individual.

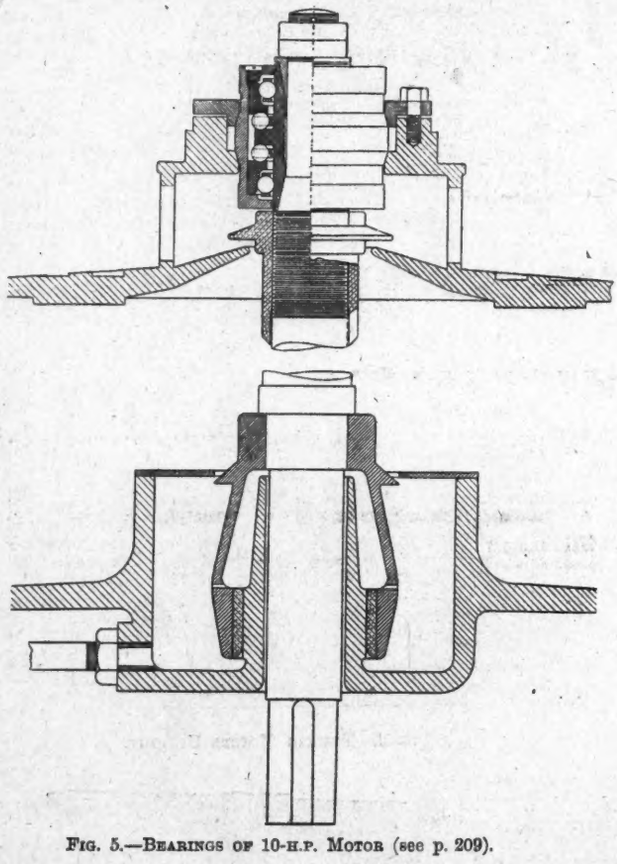
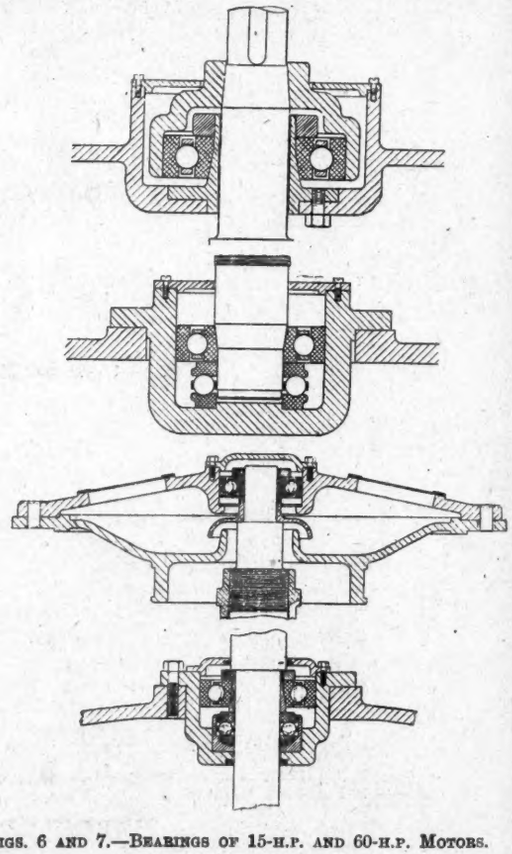


FIG. 5.—BEARINGS OF 10-H.P. MOTOR (see p. 209).



FIGS. 6 AND 7.—BEARINGS OF 15-H.P. AND 60-H.P. MOTORS.

It will be assumed that the engineer for whom this is written is in a fairly good position, and that he is neither an erector who has come to this country to finish one particular work and then return, nor a man with a special mission, who has entertaining expenses allowed him, and who on the completion of his special work also returns home.

The case assumed will be that of a single man, rather young, who comes here, as most do, to join some company in a leading capacity—either as head or chief assistant—say, in the engineering department of some concern, usually import merchants; assume also that he has no resources but his salary, and that, while he is anxious to do what most other men do, he can support life without such luxuries as motor-cars, &c. He could live either in an hotel—as some few do—or in a house by himself, or become one of a mess of two or three men. The most usual way is to share expenses with some other man or men, or to live alone. Should he decide to live in an hotel, his living expenses would be from $150 to $200 per month (1 dollar or yen = 2s.). By choosing a mess he would be able to cut down living expenses to probably $100 to $150 according to the size and style of that particular mess, and if he lived alone, a probable average, varying with the part he was in, would be $120 to $170 per month; this again, of course, would vary with the style and situation of the house.

With regard to clubs, he would need at least to become a member of the social club of the place, and would generally belong to one or two others, such as tennis, rowing, &c.

The expense of doing this would again vary greatly; the entrance fee to the social club would be from $50 to $100, and subscriptions would amount to, annually, from $40 to $100, according to the part of the country in which he was resident.

Clothes are rather expensive, an ordinary suit costing about $40, and a pair of boots from $10-$12 per pair; wines and tobacco are heavily taxed, the tax on imported tobacco being 250 per cent., and this is shortly to be increased by another 20 per cent.

Servants can be obtained at from $8 to $15 per month. A man living alone could employ a man and wife at about $25 per month, and if in a mess of more than two men these could be reinforced by a "boy" at an additional $8-$10 per month. After various club subscriptions, club bills and general expenses, such as income-tax, amusements, clothing, &c., have been paid, and taking the above as a fair estimate of bare living expenses, a single man of quiet tastes could live on from $200-$250 per month, but he would only make ends meet. Although, generally speaking, the climate is healthy, nevertheless the average man will find that he enjoys less good health than when at home, and he will either have to spend a certain sum yearly on a short holiday, or on doctor's bills. I have not considered

* Other articles on the Cost of Living abroad have been published in the following issues:—

South American Republics, Oct. 26, 1906, p. 660; Brazil, Dec. 28, 1906, p. 1031; Egypt, Feb. 1, 1907, p. 172; South Africa, Feb. 22 and April 26, 1907, pp. 326 and 668; Rhodesia, April 12, 1907, p. 606; India, March 8 and May 10, 1907, pp. 409 and 785; Australia, July 12, 1907, p. 76; United States and Canada, Nov. 15, 1907, p. 825.

the case of the married, or of those who have children, who sooner or later will have to be sent home for education, but enough has been said about general expenses to enable anyone interested to judge for himself what to allow for these special circumstances.

As may be gathered from the above, the cost of living in Japan is already high, and, unfortunately, thanks to a variety of causes too numerous to mention, it is rapidly increasing. Since the commencement of the late war, the cost of living has increased by 30 per cent.

There appears to be a wide-spread belief among English people, that living here is absurdly cheap. Twenty-five or thirty years ago, when best beef was 8 sen—2d.—per lb., and ox-tails and tongues were to be had for the asking, living certainly was cheap, but now that beef is more than 1s. per lb., anyone coming here with the idea of living cheaply will be sadly disappointed.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Combination of Gas and Electricity.

Your notes *re* co-operation between electricity and gas for heating in your issue of the 24th interested me, because we have been co-operating with the Gas Light and Coke Co. in the case of some factories requiring both power and heat.

We had secured all the power and lighting in the factory, with the exception of a small section driven from an engine and boiler, the latter supplying, in addition, steam for heating various machines throughout the factory. We could not get this section of power because of the heating problem, and are now endeavouring by co-operation with the Gas Light and Coke Co. to put the heating in their hands, enabling us to obtain the power, and allowing the small boiler and engine to be shut down, and as space is valuable, to be removed.

It was a pity no one was present to photograph the manager's face when I told him (after fruitless arguments in favour of scrapping that small plant) that I would bring in the Gas Co. to take over his heating.

There are many factories of this nature, and I believe there are great possibilities for a combination of gas and electricity in this direction.

It is a pity in one way, but it is useless to deny the fact that electrical heater manufacturers are not ready with suitable appliances for dealing with the manufacturing heating problem.

A. Hugh Seabrook,
Engineer and Manager.

West Ham Corporation Electric Supply,
January 28th, 1908.

Thermal Storage.

The letter by Mr. Davis in the Electrical Review of January 31st raises one or two points, on which, perhaps, something may be said. Even if a comparatively flat end of a pressure drum be allowed to be safe for many years under breathing action *if ductile*, is it not a wise precaution to provide against the possibility of a brittle plate some day getting into place, some plate injured by blue heat working or locally unsound, apart from the visible troubles, such as snap indentations? Indeed, is not this very exploded drum a sufficient cause to bring about the universal practice of staying? These indentations were thought nothing of until this explosion occurred, or it can truly be said that the boiler makers would not have allowed them to continue, for they would have changed the flange proportions. This is certain.

If report be true, one other such vessel has already been found similarly cracked, so that it may be that the few vessels examined by Mr. Davis are by no means conclusive evidence of the general safety of storage drums.

As regards floats and whistles, Mr. Davis must not believe that every boiler expert would accept these in lieu of safety valves. Some might do so. Some men will take risks which others regard as very dangerous, and the float and whistle has long been relegated to the museum of things not to be relied on. Safety valves have been regarded as so very important that all their weak points have been pretty well eliminated, and only experienced men know how numerous these were. Even to-day, a careful man tests the safety valves daily to find that they are not stuck, jammed, wedged, rented, plugged or otherwise incapacitated. But the safety valve possesses no superior. It is, on the whole, the best safeguard there is, and every thermal storage vessel ought to be adequately equipped, no matter if there is apparently free communication with the boiler below, for even this might be obstructed by some untoward accident. It is the business of boiler experts to be suspicious of all manner of plausible contrivances, and to this suspicious attitude the general immunity of this country from serious boiler explosions is due.

After all, why object to so simple and cheap a safeguard as a longitudinal stay-bolt with good end washers? Users are almost certain to require some such safeguard in future thermal drums. Mr. Davis should not assume that a demand for sufficient stays and proper safety-valves is any condemnation of thermal storage.

Inspector.

Cable Quotations.

I have recently had occasion to obtain quotations from the several leading manufacturers for small parcels of cable, and am surprised to find that among some six offers there is not a difference of one-half per cent. in the prices quoted.

I should be glad to know whether other engineers have had similar experience? It is quite easy to see that there is now no competition among the chief cable manufacturers, and, moreover, the prices ruling to-day are considerably higher than they were a few years ago—the market price of metals being the same.

The only remedy, of course, is to obtain tenders from foreign firms, which I am now doing.

It is all very well to talk about the iniquities of Free Trade, but it seems to me that if a tariff was adopted the British manufacturers would act as in this instance, which would be distinctly detrimental to the interests of the electrical industry generally.

Borough Electrical Engineer.

Measurement of Illumination.

The interesting correspondence in your columns on the measurement of illumination, in my opinion, emphasises one point more than anything else, and that is the necessity of coming to some definite understanding as to the plane to which all comparative tests should be referred; whether horizontal, vertical or inclined. As to the height at which measurements should be taken, all authorities seem agreed that 4 ft. is the most suitable.

In street lighting it is obvious that the measurement of the illumination on a horizontal plane is the only one which simultaneously takes into account all the light falling on the surface of the screen from all the neighbouring sources of illumination. But does this give one a just or adequate idea as to the comparative brilliancy of the illumination in the street as it appears to an observer walking along the street?

It is a mere platitude to say that vision is a physiological effect produced by illumination, but how often in our endeavours to measure illumination mathematically in candle-feet, do we forget the physiological side of the problem. And it is the "man in the street" who decides quite definitely which is a well-lighted and which a badly-lighted thoroughfare, and in the long run it is *his* opinion which sways the municipal authorities and not photometric data. Consequently, ought we not to consider what it is that gives us our impressions of street illumination, and this quite apart from the question of which is the most accurate way of measuring illumination? To my mind it matters little that measurements on a horizontal or on an inclined screen differ in accuracy, if all of them are inaccurate in so far as they

fail to give a correct indication of the *visual* impressions. And in making this statement I do not wish to be misunderstood; I am willing and anxious to hear an opinion on the subject from others more competent to judge of these matters than I am.

In walking along a street we do not, I presume, keep our eyes turned vertically downwards—that is the position we should have to assume in order to see the Trotter horizontal screen—nor do we turn our eyes upwards at an angle of 45° in order to place ourselves in the best position according to Mr. Harrison, but our line of vision is generally directed forwards and downwards at a varying and indefinite angle. Human vision embraces a very wide angle, exceeding 180° laterally and about 120° vertically, and the visual impression of the street illumination is the integrated result of all the illumination received from the area included by these angles.

Do our present methods of measuring street illumination take account of this? If not, why not?

John D. Mackenzie.

Glasgow, *January 31st*, 1908.

Cinematograph Arc Lamp.

I have a consumer who uses approximately 40 amperes at 210 volts to run his cinematograph. This not only causes serious fluctuations in pressure when switched on and off several times nightly, but, as might be expected, causes serious grumbling when his quarterly bill comes in.

The lamp details are as follows:—Hand feed, parallel carbon type with horizontal adjustment on top carbon holder; size of top carbon, 20 mm.; size of bottom carbon, 13 mm.; approximate distance from arc to screen, 36 ft. What I want to do is to reduce the heavy current consumption without spoiling the light, which any reduction of the current, with the present apparatus, does. I shall be much obliged if any of your readers can give me any suggestions.

Borough Electrical Engineer.

The Price of Tantalum Lamps.

As a contractor in the electrical line, I should like to know the reason why some firms and contractors are selling to outsiders, tantalum lamps at prices below what they are advertised at.

For instance, take the Standard lamp, which is used in almost every important place of business, and sells at a price of 2s. 9d. I have come across customers who, when I have told them the proper price for the lamp, viz., 2s. 9d., have said in a minute, "Oh, I can buy them for 2s. 6d.," and some have even had the audacity to say they can buy them for 2s. 3d. I could only tell them they had better go and get them elsewhere.

When I ask the name of the firm, I find in one or two cases it is a local firm, but in nine cases out of ten it is a traveller from some other town.

No wonder the electrical trade is so finely cut. The sooner a stop is put to the matter, the better. I should like to know what the makers have to say. Perhaps some wholesale firm will advise us what to do in this matter. I suggest that a circular be issued to all those in the electrical trade, notifying them that they must not sell tantalum lamps at a price less than that advertised by the makers.

No one who has any respect for the electrical business would do such a thing. I shall be pleased to hear what others in the electrical trade have to say to this cutting of prices.

Fairplay.

Electrical Engineer and Contractor.

I enclose you an advertisement from the current issue of a weekly advertiser, and no doubt it will interest you to know that the advertiser has had an experience in practical electrical contracting work, with me, for 17 weeks, and previous to this was employed for some time in the office of an electrical contractor.

However, when I point out that the person in question is between 20 and 30 years of age, and was willing to start work at *nothing* per week, last September, with a view to learning the business (*i.e.*, the same as an apprentice), you will readily grasp what experience he has had, and what his abilities are.

This is how the ranks are swelled, and this is what genuine engineers and contractors have to compete against when a job worth a few shillings is in the market.

A Disgusted Contractor.

[The advertisement is that of an "Electrical Engineer and Contractor" for electric lighting, heating, bells and telephones. Comment is superfluous.—Eds. E.R.]

Gas v. Electricity.

I am afraid your correspondent, Mr. S. F. Walker, has somewhat misunderstood my remarks with reference to the method of comparing the cost of our two principal illuminants. What I meant was this: that the two cheapest, and the two most expensive methods, should be compared for cost *per candle*. Therefore, we come to the fish-tail burner, and the incandescent electric lamp (I did not refer to a 16-c.p. lamp), as fulfilling these requirements in the most expensive section. Of course it is essential that the candle-power should be equal. Then what do we find? Is it necessary to write it here? Again, as regards the two cheapest. Take the cheapest incandescent gas mantle, and the cheapest arc lamp. Still the same result. Is it not so? I fail to see how the "candles that most of us remember" enter into the discussion at all, unless we get a gas burner of 1 c.p., and a miniature electric lamp of the same power.

Referring to the required greater illumination of the present day. Most things have advanced with this age of advancement; consequently, we, as advanced things, realise that it is well to abide by the instructions of the optician, viz., "Don't read in a bad light, it is a strain on the eyes." So the more light we get the better, up to a certain point. And what better light can any man require than an 8-c.p. frosted electric lamp?

I am sorry I have not had the privilege of reading Prof. Vivian Lewes's remarks on the health-giving properties of gas. But if I had, I don't think he could convince me that it is healthy to breathe the residue of burnt gas. Will Mr. Walker (or his secretary) get up near the ceiling in his study, and inhale some of the fumes given off by the flueless gas radiator? I doubt if he will find them healthy. I certainly cannot allow that Prof. Lewes's opinion has been generally accepted by the medical profession.

I presume Mr. Walker allows electricity to be the cheaper, for he says nothing to the contrary.

Unconvinced.

When comparing the advantages of electricity as an illuminant with those of gas, it should be remembered that there are three primary questions to be considered—namely, those relating to expense, hygiene and cleanliness, each a most important consideration.

The first of these three points—namely, the question of expense—is entirely dependent upon local circumstances, and cannot be considered except in individual cases. About the second, there can surely be no question. It is all-important that in a room occupied by human beings there should be no air-consuming device to vitiate the atmosphere, and spread gases and fumes of a poisonous and dangerous character.

It is generally recognised that carbonic acid gas is a grave source of danger, and one to be carefully avoided; this, I venture to say, is generally agreed upon by a consensus of medical opinion, in spite of what Mr. Sydney F. Walker quotes to the contrary in his letter in last week's Electrical Review. Gas jets may, indeed, destroy and disperse the micro-organisms which come into contact with them; but these so destroyed surely form but a small percentage of the total in a room, much of the air in which never comes near the flame of the gas.

We now come to the third of the more important considerations—namely, cleanliness. This question is satisfactorily settled on behalf of electricity by Mr. Walker's own tribute to "the familiar black mass of carbon," left behind

by the zealous and thoughtful gas jet as a residue of the numerous micro-organisms which it has obligingly slain.

To whom on earth is it comforting to find a "familiar black mass of carbon" on his "ceilings and walls" even when he realises that it exists as the sole remaining trace of ruthlessly cremated microbes? This should certainly awaken a new and grateful feeling towards gas in the heart of the householder, who surveys his blackened ceilings and counts the cost of much white-washing and re-papering.

Among the secondary advantages of electricity over gas for lighting purposes is its adaptability for use in any position and for illuminating any object. An electric standard lamp can be carried about from one table to another with merely a cord attached, whereas with gas this can only be managed by means of a tube—a clumsy and dangerous experiment.

There are other arguments in favour of electricity too numerous to discuss, such as the advantages of dispensing with matches, the superior quality of the light, the complete absence of smell under every condition, and immunity from explosion.

W. J. Henry.

Westminster, S.W., *February 4th*, 1908.

Electrical Cooking and Heating Appliances.

"Agnostic" has made it clear that we, of the electrical industry, are a part of Carlyle's "mostly." We supply a small but thankless section of the public with the best of all known illuminants, and a still smaller and possibly more thankless section with the best of all known sources of power; and as our reward, on "Agnostic's" own showing, some of us can hardly live; *and it is all our own silly faults!* We have but to arrange in a friendly manner that a nice fat profit shall accrue to each of us at each stage of the conversion of coal, copper, glass and carbon into light and power, and we should at once banish the spectre of poverty.

Bernard Shaw has told us that the social problem is poverty alone; that the only way to cure poverty is to provide everyone with a comfortable income; and along comes "Agnostic" and teaches us how to do it without revolutions, assassinations, and like unpleasantness. My purpose is altruistic; I want to put in a plea for our brethren the unemployed. Let us invent a few more stages, with nice profits attached, and the most pressing of present-day problems will be solved.

Of course, as with all evangels which are to better this wicked world, there is the black present as well as the golden future to be considered. There may be some little difficulty, for instance, until the gas world is induced to follow our example; and even then the rain of gold might not follow until paraffin and candles had been brought into line. But we need only to organise every trade in the country on the same lines, so that the rain may refresh the whole public at once, and we should all live happily ever after; most of us, naturally, by buying something cheap, and selling it at a handsome profit. In fact, the nasty, smoky, laborious business of invention and production might be made a part of our penal system; and in particular, any man who tried to cut another out, or poach on his job, would be condemned to hard labour for life.

No longer would dangerous and delicate apparatus, such as incandescent lamps, or curling iron heaters, be put in the hands of an unskilled and unsuspecting public. Under the skilled instructions of the contractor, master of the whole of electrical science—but stay! Why should the contractor work and worry himself to death? He would be keeping a new profession, that of the house-to-house consulting engineer, from coming into being. Give him enough profit, and he will be content, let us hope, leaving fees for the consultant as well.

Of course, there are difficulties about the plan; a short-sighted public seems to prefer to wear out its patience at balancing gas mantles on a porcelain fork, or its nerves at lighting gas stoves which go off pop and roar at it. In its blindness it mostly refuses to go to the kind contractor, and pay him well to show it how to insert a glow lamp in its holder or switch on a radiator. "Agnostic" rightly congratulates the public on its wholesome dread of electricity and shocks, and no words of reproval are too strong for the inhuman creatures who would lull women and children into the belief that an electric radiator is a safe and simple contrivance. Might it not be advisable to provide a key switch for such things, so that they could not be rendered alive except by a personal visit (for a fee) of the contractor? Yet we find it hard to live up to our humanitarian ideals. We compromise with our consciences by trying to believe that the gas people are just as wicked in selling gas stoves, the use of which is attended by a certain amount of danger, broadcast and cheap, without paternal care and instruction—or at least, without charging an ethical fee for it—to those for whose custom we have, alas! to compete in order to live.

So I suppose, for a little while at any rate, we shall go on with our competing, and throat-cutting, and advertising and all sorts of malpractices; perhaps, until capital punishment is meted out for these and other wickednesses.

"Agnostic's" First Disciple.

With reference to the correspondence on the above subject appearing in your current issue, as manager of a central station supplying alternating current, my chief difficulty is the trouble and cost of ascertaining the value of the supply, and I should be pleased to know how these difficulties are best disposed of.

A radiator with an hour-meter fixed to it does not provide for any alteration in the consumption due to, say, one lamp or burner ceasing to work, or the consumer occasionally replacing these with ones having a larger consumption.

If a separate circuit and watt-hour meter be provided for such apparatus with wall plugs, how can one ensure that such wall plugs will not be used to supply portable lamps, &c.?

£ s. d.

Production of Energy from Peat.

Mr. Erith's manner of conducting a controversy is as unique as his arithmetic, and as bold as his handling of facts. He seems to imagine that a controversialist may be shown to be hopelessly wrong in his facts, and childishly wrong in his figures, and may yet, by mere insistence and reiteration, carry conviction as to the justness of his conclusions upon other points, not specifically mentioned point by point.

This, of course, is not so; the value of an unassailed opinion depends upon the credit of him who gives it. If a controversialist has been shown—as Mr. Erith has—to be inaccurate and unreliable in vital facts, figures and conclusions, it is not open to him to restate other facts, figures and conclusions, not thought worthy of refutation, as proved. They go by the board—with his credit.

Until Mr. Erith shows that he has not misquoted facts, has not mishandled figures (even so late as in paragraphs 4 and 5 of his last letter) and, in fine, is not apparently dealing with matters with which he is very imperfectly acquainted, I must decline to further prolong a controversy which, on those lines, might go on indefinitely and to no useful purpose.

Thomas Tomlinson.

Dublin, *February 3rd*, 1908.

The Design of Small Transformers.

I regret that by an oversight an inaccuracy has crept into the article on the above subject in last week's issue. The weight of iron in the second example should be 6·85 lb., and the iron loss 5·2 watts instead of as stated.

F. B. O'Hanlon.

London, N.W., *February 3rd*, 1908.

The Non-Professional Assistant Engineer.

I am surprised at the inconsistency of some light and power companies who, while priding themselves on their economical methods of working, will place a man in charge who is not only ignorant of his duties as a manager, but also of the plant for which he is responsible; this state of affairs means that those under him will be called upon to

do a great deal of his business, and, at the same time, without any credit to themselves—unless things go wrong, and then woe betide them.

This class of man becomes a nuisance, and is worse than useless; what little knowledge he does gain is by sponging.

Delta.

The Boby Heater-Detartariser.

In your article headed "The Use of Heater-Detartarisers," which appeared in your last issue, the author has made prominent mention of my machine, and there are a few points upon which I shall be glad if you will allow me to make some corrections.

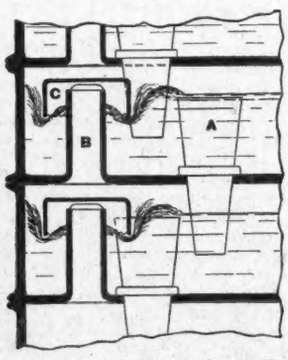
The most important of these points states that, in the case of my machine, "temperatures can, under ordinary conditions, be easily obtained of 120° to 150° F. on the discharge, or pump suction, with a temperature at the intake of 60°," and, the author goes on to remark, "these are not particularly good temperatures for feed-water," &c.

The actual temperature of the feed-water obtained at the discharge of my heater-detartariser is 212° F., and I may add that it is impossible to work my machine under normal conditions without obtaining this actual boiling temperature of the feed water. It will therefore be seen that, so far from a temperature being obtained which the author characterises as "not particularly a good temperature for feed water," the highest temperature which it is possible to obtain from exhaust steam is given by my machine.

Previous to these remarks, the author has described the construction and method of action of my machine, and here again he is mistaken. The steam which is doing the heating work does not "find its way upwards through the range by way of the steam holes through which the water is trickling down." On the contrary, a special set of tubes is provided, down which the water flows, and which are entirely distinct from those through which the steam enters.

With your permission I will describe what actually takes place, and to assist the description I enclose a small sketch showing a section through a portion of one of my heater-detartarisers.

I may say that the machine consists usually of not less than six trays, each tray being constructed in a precisely similar manner. The water flows into each tray until it



Steam and Water Tubes, Boby Heater.

reaches the level indicated upon the sketch, when it flows over the top edge of the down pipe which is marked A upon the sketch. The steam enters by the tube which is marked B, and which is sufficiently tall to project above the level of the water in the tray. The steam is therefore free to flow into the tray until it is clear of the water level; it, however, cannot gain access to the space above the water in the tray, except by flowing under the edges of a pot C, which is inverted over the end of tube B. The consequence of the above arrangement is that when the steam arrives in pot C, it blows its way into and through the water near its upper surface. If the effect of the above arrangement is carefully considered, it will be seen that, in the first place, it is impossible for the steam to blow through the water without raising a portion of the latter to its own temperature, as until that set of conditions is reached, the whole of the steam will be condensed. The water flows over the periphery of pipe A in a thin stream, and as it is a physical necessity that the hottest water will be at the surface, it follows that this hottest water (which as above shown, must have been raised to a temperature of 212°, the temperature of the steam itself), is decanted, and it is only this hottest water which flows downwards. This action is carried out in the whole of the six trays, the water (being always the water which has been raised to a temperature of 212° F.) is discharged into the hot water receiver which forms the base of the machine.

The effect of the arrangement is that no water leaves any of the trays except after it has been raised to a temperature of 212°, the carbonic acid gas driven off, and the resultant lime deposited in the trays.

The above is a scientifically designed arrangement, by which a temperature of 212° F. is reached by means of exhaust steam, and without causing back pressure upon the engines, and I venture to state that there is no other arrangement in existence by which these results can be obtained.

As long as steam is flowing through my heater-detartariser, the temperature of 212° will be found in the water which fills the base of the machine, and I may say that the limit of the capacity of the machine is its softening power, and not its heating power; it will heat to 212° a quantity of water at least 50 per cent. in excess of the normal output of the machine.

With respect to the author's references to details in connection with the inlet valve, I can only say that none of my machines are turned out with inlet valves which are of insufficient capacity for the duty for which the machine is constructed.

Referring to the injection of soda, the author does not appear to be conversant with the methods which I employ, and which are capable of proportioning the soda to the crude water as accurately as water can be measured by the best known form of water-meter.

I also think that he is scarcely up to date in his knowledge of the method by which the steam is admitted to my apparatus. The "butterfly" valve which he mentions is crude, and the valve which I employ, and which I patented some years ago, has been developed from many years of experience.

I am pleased to note the author's appreciation of the benefits which can be secured by employing feed water heaters, and it may, perhaps, not be out of place to remark that from 600 to 700 of my heater-detartarisers are in use.

William Boby.

London, E.C., *February 4th*, 1908.

Systems of Charging.

In reference to the article on "Rates and Systems of Charging," by Jacques, in your issue of December 27th, 1907, I should be glad to know how such a system as the "flat ampere per annum contract rate" could be installed on, say, a 3-wire D.C. circuit, serving motors and light to the same consumer. I quite see the possibility of installing and controlling the circuits, but what happens to the motor when the amount contracted for is exceeded? Also would this system be satisfactory to a consumer not in a position to use any power?

Unit.

Tangential Suspension of Trolley Wire.

I have read with interest the article appearing in your issue of January 24th, 1908, describing Mr. P. J. Pringle's method of constructing tramway overhead equipment.

One or two points strike me, and I am sure must interest others besides myself. In the first place, considering straight track, is it not possible with Mr. Pringle's equipment for the trolley wire to be forced up by the passage of a car sufficiently to come in contact with the metallic portion of the hanger or bracket arm?

Secondly, with a perfect overhead system of suspension it does not follow that one will have perfect motormen or trolley wheels. Such being the case, what happens at a similar curve to that depicted in fig. 8 in your article, when the trolley wheel leaves the line and jumps up between the tangential suspension and the line wire?

If the overhead gear holds up, I presume the car and trolley pole become separate units, the inquest being held the next day.

Your article does not make clear to me the method adopted for suspending section insulators.

Trusting that you will consider the above remarks of sufficient interest to warrant publication, and that before long I may be reading Mr. Pringle's annihilation of this gentle criticism—

Fault-Finder.

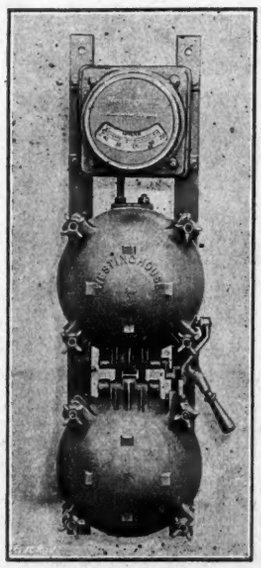
[The trolley would have to lift the weight of a span together with the resultant force corresponding to the tensions in adjoining spans; the total, even with No. 00 wire, is some 60 lb. or more, while the normal upward pressure of the wheel is only 20 to 25 lb.

As regards de-wiring, detachable trolley heads can be used with this as with the ordinary system of suspension.—Eds. E.R.]

Gas-tight Switches.

Referring to the article in the issue of this journal dated January 31st, emphasising certain points in connection with the design of an electrical apparatus for installation underground in fiery mines, it is of considerable interest to note that attention is called to the complete inadequacy of a number of designs of gas-tight switchgear placed on the market by various manufacturers for coping with the conditions of service obtaining in mining work. The nomenclature of mining apparatus appears to have become quite misleading; the significance of calling a piece of apparatus gas-tight offers no guide to the security of the purchaser as regards the suitability of the devices referred to for fiery locations.

The principles of design laid down by Mr. W. Bolton Shaw, M.Sc., A.M.I.E.E., should form a very good guide



Gas-tight Switchgear.

to intending purchasers of this class of material. The illustration above may be of interest to readers of this journal, and depicts an outfit suitable for the control of a D.C. motor; the outfit consists of an ammeter, switch and fuse, the design of the switch-box and the fuse-box being closely in agreement with Mr. W. Bolton Shaw's suggestions, and it should be further pointed out that apparatus of this class has been in actual operation in fiery mines for a period extending over two years, and has operated perfectly satisfactorily and been free from accidents of all kinds. The boxes are designed in a circular form and ribbed, so as to provide sufficiently great mechanical strength to stand any internal explosion which may occur. The joints of the boxes are arranged in the form of a spigot, which is accurately turned and fitted; the joint is of considerable length, and was determined after certain experiments, the action of the long metallic joint being such that a flame in the interior of the box, on being projected through the joint, is quickly cooled, thus ensuring that the temperature of the gases, expelled from the box due to explosion, is insufficient to ignite the external atmosphere. Experiments were carried out on this class of gear in which the boxes were filled with various mixtures, and were themselves placed in a containing chamber which was also filled with explosive mixtures. The mixtures in the switch or fuse-boxes were then ignited, and exploded without affecting the explosive gases in the containing chamber. These tests were extended over a considerable period before the designs shown in the illustration were placed on the market for commercial use. This principle of design may be extended to other classes of apparatus.

Trusting that the above may be of use as endorsing the general tenure of the extremely interesting article communicated by Mr. W. Shaw, who shows the necessity of more care being exercised as regards so-called gas-tight apparatus before installing the same in locations dangerous to human life.

It may be mentioned that it has been deemed desirable to abandon the use of the term "gas-tight," and substitute the term "flame-tight and explosion proof" as distinct from the term "gas-tight," which, as mentioned above, has lost its original significance.

For the **British Westinghouse Electric and Mfg. Co., Ltd.**

D. N. Dunlop, Sales Manager, Supply Department.

Manchester, *February 3rd*, 1908.

LEGAL.

Mayor and Corporation of St. Marylebone *v.* Pemberton and Others.

In the King's Bench Division on Wednesday and Thursday, January 29th and 30th, before Justices Phillimore and Walton, the case of the Mayor and Corporation of St. Marylebone *v.* Chas. John Pemberton, of the firm of Messrs. Pemberton & Clark, auctioneers, and others, came on for hearing on defendants' appeal against the finding of his Honour Judge Selfe in the Marylebone County Court last July, in an action for the recovery of amounts said to be due for electrical energy supplied.

Mr. Abinger appeared for the appellants, and Mr. Macmorran, K.C., with Mr. W. Cave, was for the respondent Corporation.

Mr. Abinger stated that Mr. Pemberton's premises were situate in the borough of Hampstead. In 1905 his client, with others, entered into a contract with the borough of Hampstead for the supply of electric light for ten years, at the rate of 4d. a unit. In March, 1906, the borough of St. Marylebone advised Mr. Pemberton that by agreement, under the London Electric Lighting Areas Act, 1904, certain portions of the borough of Hampstead in which he (Mr. Pemberton) was resident had been transferred to them for electric lighting purposes, and they sent him a form to fill in, whereby he would agree to pay for electric light at the increased rate of 8d. a unit. This Mr. Pemberton declined to do, and the Marylebone authority again wrote and asked him if he desired to be disconnected. He replied that he wished to be supplied according to the terms of his contract with the Hampstead authority. The Marylebone authority continued to supply him, and sent in accounts each quarter made out on the 8d. basis, and in return Mr. Pemberton forwarded cheques for the amount due on the old 4d. basis. The Council then took action in the County Court to recover the balance. The Council had raised their meter charges which were also in dispute. Mr. Abinger submitted that there was no contract existing between his clients and the Marylebone Council, and declared that the action taken by that authority in continuing to supply current under the circumstances was most extraordinary.

Mr. Macmorran, K.C., explained that certain portions of the Hampstead area were transferred to Marylebone for Local Government purposes and that an agreement was come to under the London Electric Lighting Areas Act of 1904, by which the same portions were also transferred for electric lighting purposes. This agreement was confirmed by the Board of Trade, and the section of the Act gave Marylebone the same powers over the new section that it had over other parts of the borough. The Hampstead rate was 4d. per unit, but the Marylebone rate was 8d. per unit up to 200 hours' use a quarter, after which it came down to 1d. As soon as a person was transferred from Hampstead to Marylebone, under the order, the Hampstead powers ceased, and the St. Marylebone rates and obligations arose. Accordingly, consumers became subject to the Marylebone rates. He submitted that the

appeal was uncalled for. The respondents had simply charged the appellants according to the rates obtaining throughout the borough, and no preference could be made.

The other appellants were Mr. R. J. Knox, Messrs. Myring & Co. and Mr. Sobocuiski, all Hampstead residents.

Their Lordships having heard the legal arguments submitted from both sides, Mr. Justice Phillimore, in giving judgment, held that the appeals must fail. It happened over and over again that men were much injured by alterations in borough boundaries. Parliament had transferred persons from the borough of Hampstead to that of St. Marylebone, and it happened that the rates for the supply of electricity were higher in the latter borough. Whatever Parliament might or might not have done in regard to the rights of these residents, it was evident that it had not imposed upon the borough of St. Marylebone any duty to supply electricity to the appellants upon the terms with which they had contracted with Hampstead. He could quite understand, however, that the appellants felt sore about the matter. Again, there could be no question of preference, because it would be impossible for the Marylebone authority to make any difference in the charges to residents within their area of supply. The appeal would be dismissed with costs.

Mr. Justice Walton concurred.

Bourne & Hollingsworth *v.* The Marylebone Borough Council.

This case came before Mr. Justice Ridley and a Special Jury on Wednesday and Thursday, January 29th and 30th. It was an action by the plaintiffs, drapers, of Oxford Street, against the defendants for damages for alleged breach of contract.

Plaintiffs' case was that by a contract made between the plaintiffs and the defendants the latter agreed to supply electric light to the plaintiffs for their new premises in Berners Street. Plaintiffs contended that it was an express term of the contract that the supply of the light should be at the rate of 240 volts, and that the supply should be given to the Berner's Street premises by the first week in September, 1905, when an autumn sale was to take place. The contract was partly in writing, and partly verbal, interviews having taken place in May and September, 1905, between Mr. Hollingworth and Mr. F. A. Wilkinson, and Mr. A. Wright, on behalf of the defendants. All the lamps were prepared on the premises, but the defendants broke their contract, and did not supply the light by September 25th. It was not supplied until October 9th, 1905. By a verbal contract made on September 22nd, it was agreed that if the plaintiffs would adapt their premises so as to receive a temporary supply at 200 volts instead of 240 volts, the light would be furnished within two days from September 22nd. Plaintiffs accordingly employed Messrs. Bros. who adapted the premises, but the light was not supplied within the specified time.

Defendants' case was that neither Mr. Wright nor Mr. Wilkinson had any authority from the defendants to enter into any of the alleged contracts, and that neither of the alleged contracts was under the seal of the Corporation.

Mr. Lush, K.C., and Mr. J. D. Crawford appeared for the plaintiffs; and Mr. Shearman, K.C., and Mr. McCarder for the defendants.

In the result the Jury returned a verdict for the plaintiffs on all points, but the case stood over for legal arguments as to the liability of the defendants.

Heath and Others *v.* the Brighton Corporation.

(*Concluded from page* 169.)

On Thursday, January 30th, Mr. Astbury, on behalf of the Corporation, submitted that the plaintiffs' evidence clearly established that no possible legal nuisance existed. He contended that it was impossible to deal with the case seriously. The noise was so infinitesimal that the English language could not express the character of the sound—only hyper-sensitive people could detect it. The Corporation had done everything possible to meet the plaintiffs, but as trustees of the ratepayers there must be a limit to their kindness and charity. If the Corporation lost this case, hundreds of blackmailing actions would be brought against them. If the plaintiffs agreed to the action being dismissed the Corporation would not press for costs. Beyond that the Corporation would not go.

Mr. Younger followed on the same side, and the hearing was again adjourned.

When the hearing was resumed on Friday, Mr. Justice Joyce informed Mr. Younger that he was not satisfied that the expert's report got to the bottom of the matter. He asked to be referred to any cases in which the Judge had gone himself to inspect.

Mr. Younger said he remembered one case, and that, unfortunately, resulted in serious consequences to the Judge himself—the case in which Mr. Justice Warrington met with an accident.

Mr. Hughes said that was at some experiments.

His Lordship next inquired if this was a case in which it was possible to give damages?

Mr. Younger said that if his Lordship thought fit to do so, and it was in the course of procedure, the Corporation would be the last to object to an expert being sent down, but they would rather suggest that it would be very good of his Lordship if he were to go down himself. They, however, hoped an expert would not be sent down unless his Lordship was satisfied that the plaintiffs had established their case. Of course his Lordship, if he went down, would do so for the purpose of informing himself.

His Lordship inquired what the practice was with regard to asking experts questions on their reports.

Mr. Younger, in reply, referred to the case of Buccleuch and the Metropolitan Board of Works.

His Lordship said he wanted very much, before he had done with the case, to know all about that.

Mr. Younger, on the question of damages, mentioned the Shelfer case, and said he would look it up.

Mr. Hughes then resumed his reply on behalf of the plaintiffs. He contended that there was a permanent injury to the plaintiffs' property. Mr. Hughes went on to cite a number of cases, including Rapier and the London Tramways Co., the Demerara Electric Co. *v.* White, the case of Colney Hatch Asylum, and a number of cases in connection with the point of a defence of public benefit. It could not be said that the user of the land on which the North Road works were built was of an ordinary nature—land in the middle of a residential town like Brighton—putting up an immense amount of machinery like this, very powerful machinery, which, undoubtedly, as seemed fairly clear now, shook the ground to a distance of some 30 yards.

His Lordship: I don't think it is agreed that it is a case of vibration. I don't think it is vibration in the ordinary sense.

Mr. Hughes said he quite agreed; but Prof. Boys and Mr. Swinburne both said that in their view it was probably vibration that did it—small vibrations communicated to the church, and so producing the sound. There were sufficient vibrations to produce sound, though probably not sufficient to be noticed otherwise, although Prof. Boys felt the vibration in the columns and walls of the church. On this Mr. Hughes quoted the cases of the Attorney-General *v.* The Birmingham Corporation and the Colney Hatch case. He went on to say that, considering the nature of the works, the Corporation had not taken enough land to provide a sufficient margin all round the works, which would prevent any nuisance being suffered outside. The proper course would have been to have taken more land, which could either be left unbuilt upon, or, if it were built upon, they could make proper arrangements with their tenants. That was really the proper way to carry on these works. The church was only a very short distance—about 30 yards—from the nearest point of the works. Mr. Hughes proceeded to quote the Colney Hatch case on this point, and also on the point of sending an expert, and went on to say that, while he raised no objection to an expert being sent, when Mr. Swinburne went down he could not catch the sound at first, but did so afterwards, and was able to hear it clearly. He then proceeded to criticise that part of Mr. Sparks's report in which he expressed the opinion that the hum was not so great or of such a character as to be an annoyance or to interfere with the user of the church or buildings in an ordinary manner for the purposes for which they were appropriated, and he submitted that the defendants were not entitled to annoy his clients at all, even when there was absolute silence.

His Lordship: Do you mean to say that a brief trifling annoyance is a nuisance?

Mr. Hughes replied that he was not sure that in a case of this kind people were bound to put up with even a trifling annoyance where people brought something extraordinary into the neighbourhood, and he had never heard of a case where anybody was justified in creating a continuous annoyance, even if of a small character.

Mr. Younger: It isn't a nuisance if it is small.

Mr. Hughes went on to submit that the noise would have the contrary effect to that which Mr. Sparks thought it would have, and that it would only be not annoying to people of an unusually dull nature and who were insensitive to sounds. He submitted that a very small sound going on continuously when one wanted to be quiet was a very great annoyance. There was clear evidence that it caused great annoyance to these people.

In the result judgment was reserved.

West *v.* Bristol Tramways Co.

In the King's Bench Division of the High Court of Justice, on Monday and Tuesday, February 3rd and 4th, Mr. Justice Phillimore and Mr. Justice Walton, sitting as a Divisional Court, had this case before them, on defendants' appeal from the decision of Judge Castle, sitting in the Tolsey Court.

Mr. Clavell Salter, K.C., and Mr. Vachell appeared for the appellant company, and Mr. Inskip represented the respondent.

Plaintiff, a market gardener, of Bristol, complained that by reason of the defendant company having paved the roadway opposite his garden with wood blocks treated with creosote, his plants had been injured, and he brought his action against the defendants for a nuisance. The case was twice before the learned Recorder of Bristol and a special jury. On the first occasion the jury failed to agree, and on the second judgment was entered on their findings for the plaintiff. The defendant company now appealed, pleading that they were protected in what they had done by their statute, and submitted on this ground, and also on the findings of the jury, that judgment should have been given in their favour.

Mr. Clavell Salter, K.C., in support of the appeal, pointed out that Parliament had imposed upon the defendant company the obligation of maintaining a portion of the roadway, and they had at all times to execute the repairs under stringent and mandatory orders. They were, in fact, in a quasi-public position, and were made responsible for the middle part of the roadway as if they were a highway authority. He submitted, first, that they could not be

liable in an action for doing what they were told to do by Parliament; and secondly, that on the finding of the jury as to the reasonable necessity of what they had done they were entitled to judgment.

Mr. Inskip submitted that while it was the duty of the company to pave the roadway, they were not entitled to use a chemical preparation, the fumes of which injured the property of others.

Mr. Justice Phillimore, in giving judgment, said in his opinion the appeal must be dismissed. No doubt the Tramway Co. was ordered to keep in repair a portion of the highway, and to do it by using wood paving, but the Act did not state that they were to use wood blocks treated with creosote. The plaintiff was therefore entitled to recover in respect of any damage he had suffered in consequence of the action of the company.

Mr. Justice Walton concurred, and the appeal was dismissed with costs accordingly.

Leave to further appeal was granted on the defendant company consenting not to ask for costs of going to the Court of Appeal in the event of succeeding in that Court.

The Patent Exploitation, Ltd.

An application was heard by his Honour Judge Shand at the Liverpool Court of Bankruptcy on January 31st, in which Mr. G. H. Thompson, solicitor, asked for an order staying all proceedings under a winding-up order made in July, 1907, in the matter of the "Patent Exploitation, Ltd.," of 8a, Lord Street, Liverpool. The application was made on behalf of Mr. Wm. Phillips Thompson, a creditor and contributory of the company, and Mr. G. H. Thompson, who also represented all the other creditors and contributories, asked for a temporary stay pending a further application to the Court to rescind the winding-up order.

The Solicitor submitted and read an affidavit by Mr. William McConnal, the liquidator, in support of the motion, and explained that the petitioning creditors were the Electrical Power Storage Co., Ltd., of Great Winchester Street, London. The difficulties of the "Patent Exploitation, Ltd.," had arisen in consequence of prolonged litigation with Messrs. Siemens, in which the "Patent Exploitation, Ltd.," claimed heavy damages. That case eventually went to the House of Lords, and in the result an inquiry was ordered as to the amount of damages. The whole of the damages expected to be recovered by the Patent Exploitation, Ltd., had been assigned by that company to Mr. Wm. Phillips Thompson, who had carried through the litigation, which had now been disposed of, the damages being fixed at £5,000. That amount would shortly come to hand, and it was the intention of Mr. W. P. Thompson, who was the promoter of the Patent Exploitation, Ltd., and also its largest shareholder and creditor, to pay off all claims and then to apply to the Court to rescind the winding-up order. Mr. W. P. Thompson had paid out the petitioning creditors, who were now no longer creditors, and all parties concerned were now before the Court. All claims would be paid off before further application would be made in regard to rescinding the winding-up order.

Mr. Gittens, Official Receiver, asked if the petitioning creditors had had notice of the present application.

Mr. G. H. Thompson produced a letter from Messrs. Hill, Dickinson & Co., solicitors, to the effect that the petitioners had been settled with.

There was no opposition to the application, and

His Honour granted a stay of all proceedings under the winding-up order for one month.

Reynolds *v.* Lanarkshire Tramways Co.

On Tuesday, last week, according to a Scottish newspaper, Lord Dundas closed the record and ordered issue in an action by William Reynolds, contractor brusher, against defendants for £500 damages for personal injuries. About 5.50 on the morning of Saturday, August 3rd, 1907, the pursuer boarded one of the defenders' cars between Cambuslang and Motherwell. As the platform of the car was crowded with passengers, the pursuer was compelled to stand partly on the platform and partly on the step. His left hand was on the brass rod supporting the canopy and his right on the iron rod at the rear of the car. His fare was collected while he was standing there, and after that, when he had travelled about 250 or 300 yards, he suddenly received a severe electric shock, which rendered him unconscious, and he fell on to the roadway. He avers that he has been seriously and permanently injured by the shock. The defenders deny fault, and state that the pursuer was injured through falling when attempting to board a car while it was in motion. They say that his injuries are grossly exaggerated, and explain that the car was a workmen's car with cheap fares, and that any claim of compensation by a passenger on such a car is limited to £100.

Buck *v.* Underground Electric Railways of London, Ltd.

In the Lord Mayor's Court last week, before the Recorder and a jury, plaintiff, a labourer, sued for damages for injuries sustained through the alleged negligence of the defendants' servants. Mr. Moyses appeared for the plaintiff, and Mr. Sykes for the defendants. Plaintiff was a labourer employed by the contractors who built the Strand station for the defendant company. The shaft, 130 ft. deep, had already been sunk, and planks were placed across it for the contractors' men to get from one side to the other. It was a well-known fact that such gangways could not be touched without the consent of the foreman of the job. On September 30th last the plaintiff attempted to cross the gangway, not knowing that one of the company's employés had removed one of the planks. The result was that he tripped and fell, and was thrown against the iron framework of the shaft, breaking his leg. He had been unable to work since, and it was stated that he might never again be able to follow his former occupation. The defendants admitted that the plank had been removed by one of their workmen, but said that the plaintiff was aware of the fact and had said that he would call whenever he wished to cross and the plank would then be replaced. In this way they stated that the plaintiff had been guilty of contributory negligence, as he did not call before he crossed on the occasion on which the accident occurred. Evidence to this effect was called for the defence, but the Judge said he did not think that this could be construed into contributory negligence.

The jury found for the plaintiff, and awarded him £75 damages. Judgment was entered accordingly.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The Bandy Electric Punkah.

Although, to the uninitiated in such matters, the cooling breezes obtained with the average electrically-driven fan or air-propeller leave little to be desired, yet residents in our Indian dependencies have always had a preference for the dark-skinned punkah-wallah and his swaying curtain. Many mechanically-driven punkahs have appeared, but unfortunately they have proved lacking in a most essential characteristic of the native-worked punkah—viz., the kick which the punkah-wallah gives by a sharp twist of his wrist, usually at every other stroke, and which has resulted in the saying that there is a Bengal or cool side to the punkah and a Bombay or warm side.

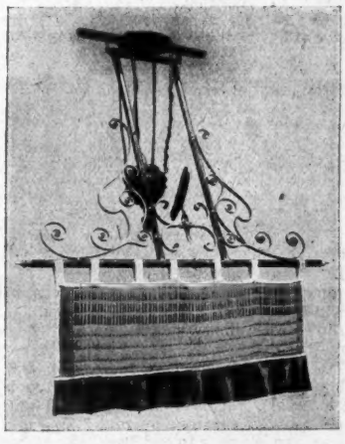


Fig. 1.—"Bandy" Punkah-Wallah.

The Bandy electric punkah, of which Messrs. Bergtheil and Young, Ltd., of Camomile Street, E.C., are sole patentees and manufacturers, is a successful attempt to provide two "Bengal sides" to this appliance, and is shown in fig. 1.

The arrangement consists of a rigidly suspended A.C. or D.C. motor, with a conical pulley on the motor shaft. A leather-covered quadrant in a skewed position, fixed to a spring-controlled arm, is attached to the punkah frame. The rotation of the pulley rolls the quadrant along, giving the punkah a sharp kick, carrying it to a point from which it commences to swing back by gravity; this time, owing to its skewed position, the quadrant strikes the opposite side of the pulley, transmitting another kick to the punkah on its return stroke.

Punkahs of this type are made for ship, railway, and private use with suitable modifications in design.

Inverted Contact Gear for Arc Lamps.

The London Electric Firm, George Street, Croydon, have sent us particulars of some special inverted contact gears supplied to the Metropolitan District Railway for their Hammersmith Station. The gear consists of a contact device, the fixed part of which is secured to the bracket, and the movable part to the upper end of the tube carrying the lamp. A winch line draws up this tube, telescoping it through the fixed part of the contact, and when the lamp is sufficiently high it is swung round over the roof for trimming.

The contact device is an adaptation of the firm's patent "one-working-part" type, and when the lamp is in its normal position the weight is entirely off the rope. The winch is of their

self-sustaining type, without ratchets, pawls, or gear wheels, and will not run back, thus avoiding accidents.

Motor-driven Portable Lathe for Locomotive Repair Shop.

The flexibility of the electric motor drive has brought into use several types of convenient and labour-saving portable machines. A notable example is the portable bolt-turning lathe designed for use in locomotive repair shops. The illustration (fig. 2) shows a lathe made for this purpose by WILLIAMS, WILSON & Co., of Montreal, equipped with a Westinghouse motor. The unit is compact and is mounted on wheels. It can be lifted by a crane and placed beside an erecting pit, and then moved as desired by hand. When in its working position the machine rests on the rear wheels and front legs. To move it, the legs are lifted and the front wheel is brought into contact with the floor by simply lowering the handle, which acts as a lever.

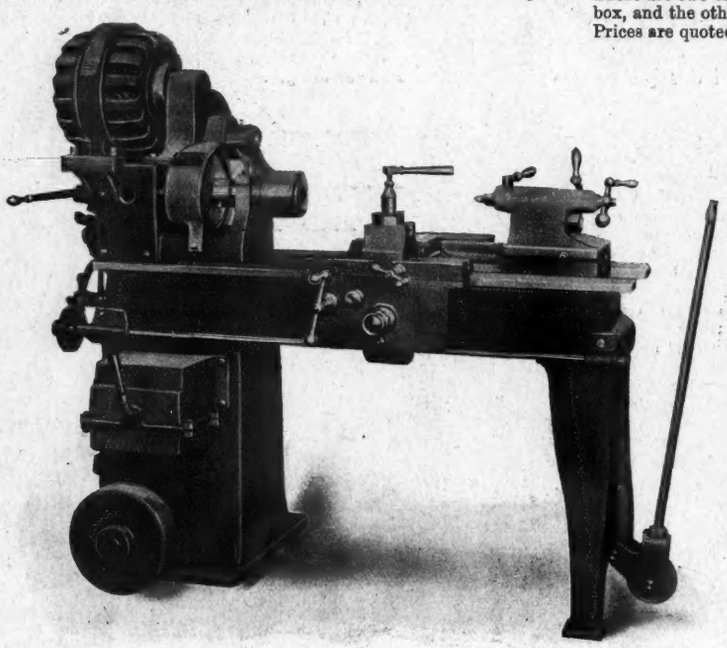


FIG. 2.—PORTABLE ELECTRICALLY-DRIVEN LATHE.

The motor operating the machine in the illustration is of the Westinghouse induction type, 2 H.P., 1,700 R.P.M. It is connected through a friction clutch providing for either 200 or 400 R.P.M. of the spindle. Direct-current motor applications are equally successful.

The current supply is taken by flexible cables from plugs located at convenient intervals. The advantage of using a machine of this type on repair work is readily apparent. It both obviates the necessity of innumerable trips to and from the machine shop and the consequent loss of time, and permits the mechanic to carry on his work without interruption.

When not in use the machine can be moved out of the way, or forms a valuable and convenient auxiliary to the machine-shop equipment.

Gwynne's Self-charging Centrifugal Pump.

MESSRS. GWYNNE, LTD., of 81, Cannon Street, E.C., have just made an ingenious application of their patent charging apparatus to their centrifugal pumps. The arrangement is exceedingly simple, and its operation is carried out by means of the handles of two cocks B and C, shown on the accompanying figure.

In an actual test with this pump in Messrs. Gwynne's works, no difficulty has been found in charging a pump with a suction head of 27 ft.

Turning to the illustration (fig. 4), it will be observed that the water vessel A is filled through its open top; the cocks B and C being open; this fills the main pump as well. The water is prevented from running out of the pump by flap-valve D. The sluice valve E on the delivery, being shut, the pump is started, and immediately delivers water through the cock B, and through the ejector F back into the water vessel A, and so to the suction of the pump through the cock C. This action at once sets up a vacuum in the pipe G, which is connected to the main suction-pipe of the pump H. The air from H is delivered with the water through the ejector into the water vessel, from the open top of which it escapes into the atmosphere. When the pipe H is charged, water finds its way up pipe G, and so into the water vessel. When this overflows through pipe J, the cocks C and B are shut and the sluice valve E opened, the pump immediately commencing to work. The whole operation takes from one to two minutes.

The water vessel A can be a tank on the pump-house wall, if found more suitable for any particular case. It will be seen that this plant will be useful in a very great number of cases, especially where steam is not available. There are really very few fittings extra to what are required in an ordinary centrifugal pump. The sluice valve and retaining valve are, in the majority of cases, fitted in the pipe systems.

"Automatic" Portable Lamp.

A useful little novelty is being placed on the market by MR. M. BERLINER, of 47/51, Park Street, Southwark, S.E. It is an automatic portable electric lamp for suspending inside the doors of wardrobes, bookcases, dark cupboards, &c., and, indeed, all dark places where light is only occasionally required. The idea of the fitting will be at once gained from fig. 3. The light is switched on and off respectively by lifting and replacing the bell-shade shown on the hook, the battery being contained in the box above it. There are two classes of fitting, No. 1 having a metal cover to the box, and the other being de luxe finish, solid mahogany, or walnut. Prices are quoted in a list recently issued by Mr. Berliner.

FIG. 3.—AUTOMATIC PORTABLE LAMP.

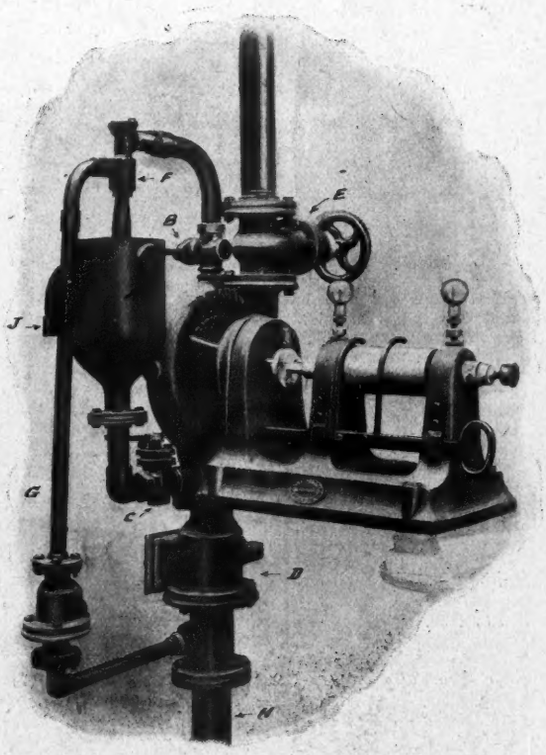


FIG. 4.—GWYNNE CENTRIFUGAL PUMP WITH SELF-CHARGING DEVICE.

G.E.C. New Telephone Apparatus.

Amongst the apparatus described in the Telephone Catalogue 10th edition) of the General Electric Co., Ltd., 71, Queen Victoria Street, E.C., are several interesting novelties. Fig. 5

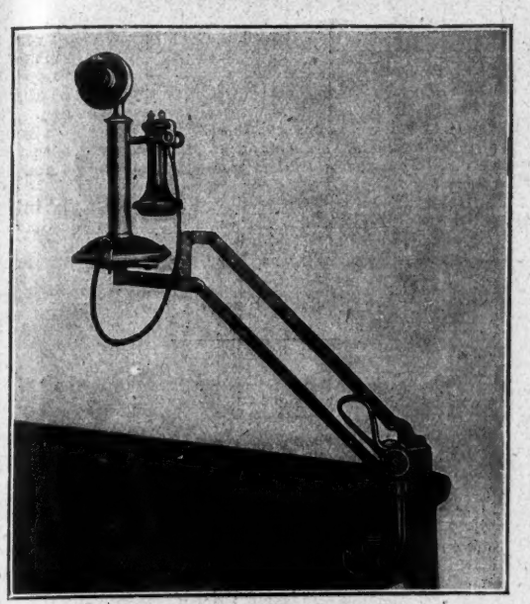


Fig. 5.—"Phone-Eze" Telephone Bracket.

Fig 6.—Self-Replacing I.-C. Telephone.

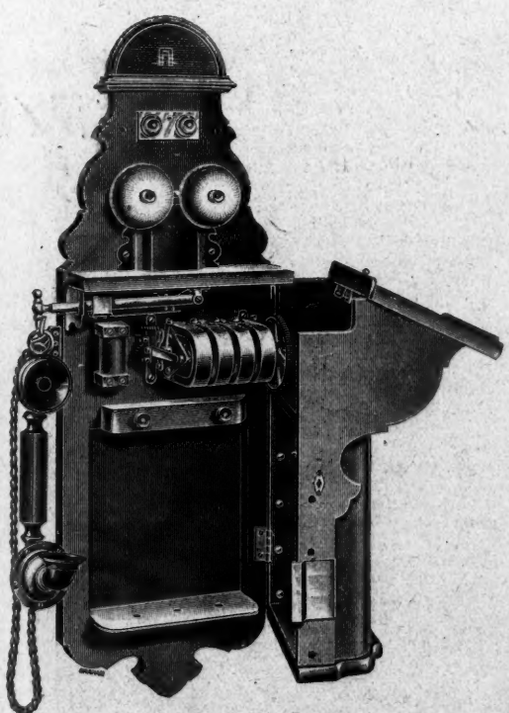


Fig. 7.—"Colonial" Telephone Set.

shows one form of the "Phone-Eze" bracket, which, being of the parallel-motion type, is suitable for use in connection with the table sets adopted by the National Telephone Co. and the Post Office. The device has a very wide range of movement, and stays wherever it is put.

Fig. 6 shows the "S.R." (self-replacing) battery-call intercommunication telephone. All the connections are made on the hinged backboard; and as the act of replacing the telephone restores the apparatus to the normal position, it is always left in

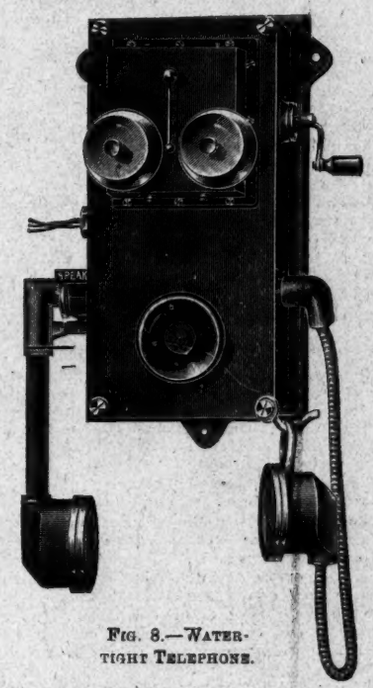


Fig. 8.—Water-tight Telephone.

a condition in which the user can be called. Fig. 7 is a magneto-call telephone specially made for tropical climates, for bridging and long-distance working; it is, in fact, the Australian Commonwealth standard pattern for magneto exchanges, and a large number are in hand at the present time for that Government. Fig. 8 is a magneto-call watertight and gastight telephone for mines, engine rooms, &c. Fig. 9 shows a very neat central-battery wall telephone set for private use, in which the cover is of enamelled steel; this is a remarkably compact little set, and is

Fig. 9.—Steel-Cased Central-Battery Set.

very suitable for hotels, private residences, &c. It is interesting to note that the company is now in a position to carry out complete central-battery exchange installations of any magnitude, public or private; full particulars are given in the catalogue, which includes also a great variety of fire-alarm apparatus (amongst others, Lieut.-Col. Fox's thermostatic heat detector), electric clocks, bells, &c. We have selected but a few of the interesting features; those who wish further particulars are referred to the catalogue itself.

E

PARLIAMENTARY.

London and Windsor Motor Road, Tramroads and Tramways Bill.

On Monday last Mr. Campion, the Examiner, was engaged for the whole of the afternoon on the consideration of objections by the London United Tramways, Ltd., and the Roads Construction Co., alleging that the promoters of the London and Windsor Motor Road, Tramroads and Tramways Bill had not complied with standing orders.

Mr. Cripps, for the London United Tramways, Ltd, first made a general allegation that the plans as deposited were deficient. He pointed out that the road was simply marked with a centre line, and contended that as a general principle in a scheme of this sort the plans ought to indicate to people affected what it was proposed to do. He understood that the proposal was to make a motor road and to place tramroads upon it, but it was impossible with the plans before them to check the estimates. The road was to be made on an embankment, and the cost would depend upon the width of the top, and yet they did not know what that was to be. He agreed that in the case of a railway it was sufficient to show the works by a centre line within the limits of deviation, but with railways the width was a well-ascertained thing, and as the estimates were for a single or double line everyone knew what the line cost. Here they had no such information, for the road might be 40 ft., 60 ft. or 100 ft. wide. Consequently it was impossible to check the estimates or to see whether the proposed capital was sufficient.

Mr. Freere, for the Roads Construction Co., said that if the promoters had framed their Bill so that it could only be read in one particular way they might not have had so much to say, but they had made the motor road and the tramroads absolutely distinct works, and it seemed to him that if the company obtained their powers there would be nothing to prevent their dropping the motor road and keeping the tramroad. The promoters limited their estimates for the motor road as if it were a railway, and then estimated the tramroads on the basis of relying upon having the motor road there and thus dispensing with the detailed estimate they would otherwise have had to make. By this means nothing was put down to the tramways as regarded embankment and other constructive works, and reliance was placed on the fact that the tramway was to be put on the top of the motor road. Consequently only 5 per cent. was deposited on the tramway scheme. He admitted that it was very ingenious, but hoped it was a practice the Examiner would not countenance.

Mr. Kennedy, addressing the Examiner for the promoters, contended that all the standing orders had been complied with. It would be found that on the plans the centre line was described as being the centre line of the motor road and tramways. In considering the form of the Bill the promoters had several difficulties to face. A tramway was only a tramway so long as it was on a public road, and directly it went on to private land it became a tramroad. When it became a tramroad the standing orders in respect of railways became applicable. In this case they had two classes of orders relating to roads and tramroads, and the further complication that at the Windsor end a portion of the tramline ran on the public road, and thus the standing orders relating to tramways also came in.

Mr. Fraser, the engineer of the scheme, was called, and said that in the case of a railway all he had ever shown on the plans was a centre line within the limits of deviation, and, consequently, in respect of these tramroads, if there had been no suggestion of a motor road, the rule regarding railway plans would have applied. There was no obligation imposed by the Standing Orders to show the space which might be left between two lines of railway. Witness proceeded to go through the estimates, and pointed out that he had given all the details which were necessary.

In cross-examination by Mr. Cripps, Witness said the intention was to form a road. The centre would be a motor road, and on either side there would be a tramline. Inside towns where property was expensive, the width of the whole road, including the tramways, would be 60 ft. Where land was cheaper, the width of the motor road alone would be 60 ft., and with the tramroads the whole width would be 84 ft. It was on that basis that the estimates had been made, and he saw no difficulty in engineers estimating and checking the cost. As a matter of fact, the promoters had given a great deal more information than they need have done.

Mr. Kennedy asked if Mr. Cripps suggested that these were tramways and not tramroads.

Mr. Cripps said that was one of his difficulties. If tramlines only were being constructed, he admitted that they would be tramroads, but as the tramlines were to be constructed along a road, there was a question whether they were not tramways.

The Examiner: But it is their own road.

Mr. Cripps: That is what I want to know.

The Examiner said a tramroad had to be laid along something.

Mr. Cripps said that the road would be for vehicular traffic, and with the exception that a certain portion of the public would be excluded, it would be an ordinary road.

In answer to Mr. Freere, Witness said it would have been possible to give the width of the road in the plans, but he thought it would have led to confusion.

Replying to the Examiner, Witness said that in the extensive parts where the road was only 60 ft. wide, motors would also use that part of the road on which tramlines were laid.

Mr. E. Cooper, engineer, with 40 years' experience of preparing plans for Parliamentary Bills, expressed the opinion that the plans as deposited complied with the Standing Orders. He was six days before the Examiner on the Hammersmith and City Railway Bill, and was, therefore, familiar with Standing Orders. In his opinion questions relating to the position of the tramlines and other matters were for the Committee to whom the Bill was committed.

Mr. R. Hassard, engineer, with 50 years' experience, corroborated Mr. Cooper.

The Examiner asked if there was any reason why a system should not be adopted similar to that in regard to private properties, which were set out on a large scale. The position seemed to be that Parliament had not got the information it ought to have, but he himself had. He quite understood that it would be difficult, if not impossible, to carry out a more accurate scale of delineation through the whole work, but was there any reason why it should not be given on a larger scale on one sheet of the plans, with a note to the effect that the promoters were bound to that throughout their work?

Mr. Kennedy said they were quite willing to give that information, but his point was that there was nothing in the Standing Orders to compel them.

The Examiner said he realised that that was an entirely new work.

The further consideration of the Bill was adjourned.

As the result of a conference between the Chairman of Ways and Means and the Chairman of the Committees of the House of Lords, it has been decided that the following Bills shall originate in the House of Lords:—Bristol Tramways, Croydon and Southern District Tramways, Great Northern, Piccadilly and Brompton Railways, Highgate Hill Tramways, London and District Electric Supply, London and Windsor Motor Roads, Tramroads and Tramways, London County Council Tramways, London Electric Supply, London Motor Roadways Approach, London (Westminster and Kensington) Electric Supply Co., Metropolitan District Railway, South Wales Electrical Power, and West London, Barnes and Richmond Tramways.

Metropolitan Electric Tramways Bill.—This Bill came before Mr. Campion, the Examiner, on Monday for proof of compliance with standing orders. Mr. Pritt represented the promoters, and Mr. Browne the memorialists, Messrs. J. and. M. Salmon. After objections had been argued and overruled, standing orders were held to have been complied with.

Telegraph Acts Amendment.—In the House of Commons on Tuesday, the Postmaster-General presented a Bill, which was read a first time, to amend the Telegraph Acts, 1863 to 1907, with respect to the construction and maintenance of telegraph lines for telephone and other telegraph purposes.

BUSINESS NOTES.

Catalogues and Lists.—The Indestructible Cable Co., 47-51, Park Street, Southwark, S.E.—12-page pamphlet giving list of prices and particulars of their wires and cables insulated on the "Indestructible" system.

Messrs. Turners & Manville, Ltd., Hopetoun House, 5, Lloyd's Avenue, London, E.C.—This firm who are sole agents in this country for the sale of "Voltax" compound, have sent us a couple of leaflets relating to the material, one entitled "Electrolytic Action and its Prevention," the other containing Press notices concerning it. We understand that the material is waterproof and a preservative of wood and metal, and has a dielectric strength of 300 volts per mil. It is melted in the same way as tar, easily poured into sealing bells, joints or boxes, and it is claimed to stand extreme temperatures without freezing or cracking, and to have no chemical action. "Voltax" is used for preserving transmission poles from dampness and decay, for use in manholes, cable-joints, junction-boxes, and for construction of underground cable systems. It is exclusively, and we are told satisfactorily, used by the New York Central and Hudson Railroad for insulating their three-phase high-tension cable-joints 11,000 volts.

The Kevan Electric Co., 88, Charing Cross Road, W.C.—Mailing card relating to the daylight effects of the "Kevan" electric lamps.

Crystelco, Ltd., Kempston Works, Bedford.—Leaflet drawing attention to their incandescent lamps which are "used all round the world."

Messrs. Julius Sax & Co., Ltd., 100, Charing Cross Road, W.C.—New catalogue (48 pp. enamelled paper) of electric light fittings. A view of part of the show-rooms leads the way for a large number of illustrations of various types of table-standards, brackets, cord-pendants, three-light pendant fittings, electroliers, Adams, Georgian, Flemish, Louis and cut-glass fittings; also ceiling fittings, lanterns, and many other things of a like kind. Some water-tight fittings, examples of switch-plates, and of glass and silk shades follow later in the book.

The Sun Electrical Co., Ltd, 118-120, Charing Cross Road, London, W.C.—New 12-page list giving particulars and prices of a number of advertising signs and flashers that are illustrated. The "Singleite" (one lamp) signs for outdoor service, also other types of hanging, desk, counter, and changing colour signs, and the "Sun" motor flashers, are included.

Mr. Robt. W. Paul, Newton Avenue Works, New Southgate, London, N.—New catalogue consisting of a large number of illustrated lists brought together in an expanding binder. Some notes concerning the works and views of the north and south shops are first given. Additional buildings were erected in 1907 to accommodate a suction gas plant, an engine and dynamo for lighting the works, and certain plant and apparatus for testing purposes. A separate laboratory has also been provided for experimental work, and is supplied with current up to 1,000 amperes and pressures to 10,000 volts. The pages that follow contain some clearly printed matter and blocks relating to the firm's various electrical standard and testing instruments. In the different sections there are included resistances, rheostats, pointer galvanometer and test-sets, reflecting galvanometers and accessories, condensers, cells and potentiometers, A.C. instruments, and keys and sundries. The catalogue, of course, includes Mr. Paul's most recent designs, as well as his standard apparatus; but it need hardly be said that further additions will be made from time to time, and the binder makes provision for the inclusion of these.

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Revised list (36 pp.) containing descriptive and tabulated particulars, tables of dimensions and weights, also some good half-tone pictures, of the "Castle" types of continuous-current motors and dynamos. Some notes and diagrams give directions for coupling up motors to supply mains. Motor-starting rheostats, Holmes-Page quick-break chopper type switches, and fuses in cast-iron boxes, are listed, and a view appears of the "Holmes-Clayton" three-phase A.C. motor of the squirrel-cage type.

Messrs. Bagshawe & Co., Ltd., Dunstable Works, Dunstable.—Leaflet relating to their buckets for elevators.

Messrs. Morris & Lister, Coventry.—Revised list describing their 1908 pattern of eddy-current testing brake, the mechanical construction of which has been simplified, while, at the same time, the makers have been able to secure continuous rating instead of short time rating, and a reduced price per H.P. This has been effected by doing away with the outer pole rings and substituting a disk of iron, attached to each copper disk itself, on which is mounted a series of vanes which promote radiation from the heated disk, and at the same time induce a current of air to circulate round the exciting coils. For high-speed work, such as is demanded by the makers of petrol motors, the brakes can be run at speeds as high as double those listed at correspondingly greater H.P. For such purposes the brake is frequently fitted with ball bearings which are better suited to high-speed work.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Bloomfield Street, London, E.C.—We have received half-a-dozen three-colour postcards, each of which shows very strikingly one or other of their patent fuse-boxes.

The Electrical Power Storage Co., Ltd., of 4, Great Winchester Street, E.C., have issued an effective hanging show-card of their E.C.C. dry and Extra-Sec batteries, for hanging in contractors' or salesmen's shops, &c.

Messrs. W. T. Glover & Co., Ltd, Trafford Park.—Reprint of a paper read by Mr. G. G. L. Preece before the Institution of Mining Engineers, on "Improvements in the Design of Cables for Collieries." Copies may be had on application to the firm.

Messrs. R. Wolf, 7, Laurence Pountney Hill, London, E.C.—This is a very fine catalogue of 60 odd pages describing fully the firm's patent superheated steam locomobiles, with removable tubes (portable and semi-portable engines) which they make in various sizes from 10 to 600 B.H.P. The most striking feature of the book is its illustrations, the like of which we do not remember having seen used in a catalogue, at any rate, for a long time past; they consist of excellent photographic prints gummed in the centre of a light brown tinted page and producing a fine effect. One of them shows a portable set for electric lighting purposes, and another is a view of the electric light and power station (a 250-385 effective H.P. locomobile set) at the firm's Sabtke works. These locomobiles are claimed to form a very compact and neatly arranged steam power unit, occupying very little space. That they are economical in coal consumption is shown in reports of tests given in the book, where the following consumption figures appear:—2·12 lb. per B.H.P. per hour for a portable single cylinder locomobile of 24 B.H.P.; 1·37 lb. per B.H.P. per hour for a compound condensing locomobile of 100 B.H.P.; 1·23 lb. per B.H.P. per hour for a tandem compound condensing locomobile with two superheaters of 55 B.H.P. We are informed that recently the makers have turned out a 500-H.P. tandem compound locomobile, which has given a consumption of only 1·11 lb. of coal per B.H.P. per hour. The variation in speed of these engines is claimed to be reduced to a minimum, being guaranteed not to exceed 1 in 150 revolutions when running under full load, a point of great importance for electricity generating stations.

Messrs. Willans & Robinson, Ltd., Rugby.—Advance copy of 12-page pamphlet just issuing, in which is contained a description of the mixed pressure type of turbine, the introduction and development of which originated with them so far as enabling the different conditions to be met with in one turbine are concerned. Diagrams are printed of the conditions met by this turbine.

Isaria-Zahler-Werke, Munich.—Set of leaflets relating to table, bracket port-hole, desk and wall fans, and small industrial motors.

Mica Insulating Materials.—The Frankfurter Glimmerwarenfabrik, Landsberg & Ollendorff, who have long had extensive manufactories situated in one of the principal industrial quarters of Frankfort-on-Maine, are large importers of raw mica, which they work up in their electrical department into insulation materials for electrical purposes. They have had a wide experience in this sphere, and are constantly supplying the leading electrical firms in Germany and in some other countries. They supply raw mica in all qualities customary in the market which have proved suitable for the purposes in question, and of these a large stock is always on hand; mica cut to sizes and according to shapes, such as disks, plates, segments, &c.; micanite (with the registered name "Megotalc"), a composition of raw mica pieces with other combining and insulating materials, supplied in flexible sheets and hard plates, in composition with linen, paper and rubber paper; also micanite in moulded pieces, such as disks, rings, tubes, and many other forms. Moulds are in stock for the most required types of rings and tubes. A new speciality of the firm's is the insulating material "Pilit," which is non-hygroscopic, and unaffected by hot oil. It is supplied in flexible sheets, hard channels and tubes. It is patented in Germany, and patents have been applied for in most other countries. The Frankfort factory is equipped with modern machinery.

Book Notices.—*Cours d'Electricité.* Vol. III. By H. Pellat. Paris: Gauthier-Villars. 1908. Price 10 fr.—This is the concluding section of a work, of which the first part, on Electrostatics, Ohm's Law, and Thermo-electricity, appeared in 1901; the second, on Electro-dynamics, Magnetism, Induction, and Electro-magnetic Measurements, in 1903; while the third, the present issue, deals with Electrolysis, Electro-capillarity, and Gaseous Ions. The author's aim has been to show how the fundamental laws of electrical science can be solidly established, and the principal deductions made therefrom, without the use of high mathematics. In Vol. III he deals with the laws of electrolysis based upon experiment, and the theory of electrolytic dissociation; polarisation, and primary and secondary cells; the applications of the laws of thermo-dynamics to the subject; contact potential differences, and the ionisation of gases. The treatment is very ample and clear, and the illustrations and printing are admirable. British students who desire to improve their knowledge of French whilst studying the principles of electrical science—an excellent combination—cannot do better than pursue their studies with the aid of such a work as this.

L'Année Electrique (1907). By Dr. Foveau de Courmelles. Paris: Ch. Béranger. Price 3,50 fr.—This review of the year's progress in electricity, electrotherapeutics and radiography, now appears for the eighth time. About half of it is devoted to general applications of electricity, and the rest to the two special subjects mentioned. Some of the inventions and ideas included by the author under the head of electrical progress are more or less trivial or quaint rather than serious contributions to science, but on the whole the work appears to form a very comprehensive *résumé* of the year's doings, and, taken with its predecessors, should be useful as a work of reference.

Arithmetic of Electrical Engineering.—London: Whittaker and Co. Price 1s. net.—This book has been prepared as a companion volume to the long series of works on electrical engineering issued by the publishers. Brief explanations of elementary laws are given in each chapter, followed by numerous worked examples illustrating different phases of the subject and practical applications; abundant examples are also provided for the student to work out for himself, taken largely from the City and Guilds examinations. The answers to the latter are collected at the end of the book. The examples are of a very suitable character, and the explanatory matter is also satisfactory in the main. Current and power are correctly handled. On p. 35 "candles per hour" gives a wrong impression, as candle-power is a measure of *rate*, and the phrase is in fact meaningless. On p. 71 B.T.U. is used for British thermal unit, but this is objectionable because the same symbols are often used for Board of Trade unit, and therefore B.TH.U. is preferable. Throughout the book the plural of centimetres is written cms. instead of cm., and of pounds lbs. instead of lb.; grammes are abbreviated to grms., instead of gm. There is more than enough confusion between units and systems already, without aggravating the trouble by departures from the abbreviations and expressions already approved by international authority. But apart from these minor defects, the work is a very good and useful one.

Annuaire pour l'an 1908. Paris: Gauthier-Villars. Price 1.50 fr.—This annual, published by the Bureau of Longitudes, contains in addition to astronomical data tables relating to physics, chemistry and engineering. This year special articles are included on the distance of the stars, and the school of practical astronomy of the Observatory of Montsouris.

Mesures Electriques. By Eric Gerard. Paris: Gauthier-Villars. Price 12 fr.—This is the third edition of a treatise, the name of which is a household word amongst French electrical students, and, we should add, Belgian, seeing that it represents the substance of lectures delivered by Prof. Gerard at the famous Institute Electrotechnique Montefiore, Liége. In view of the rapid developments which take place without ceasing in the design, construction and use of electrical apparatus, the author has found it necessary to remodel a great part of the work, and to revise the rest thoroughly. The ground covered includes measurements of all kinds useful to the electrician, both in the laboratory and in industrial work, and the applications of the various methods described are fully illustrated in connection with electric lighting and traction, telegraphy, electrical machinery, &c.; the latter portion of the work is that which has received the most drastic handling, and the section has been brought well up to date. The book needs no recommendation, except to those who are not acquainted with the earlier editions; as in the same author's excellent *Leçons sur l'Electricité*, the treatment is characteristically lucid and precise.

We have received from the Electrocraft Publishing Co. a copy of their illustrated list of approved electrical fittings, and also the revised National Electric Code, illustrated, price 50 cents. In this book are illustrated various fittings which have been approved

on passing the tests specified in the last edition of the National Code. Some of the articles illustrated are said to be the best at present obtainable, although they may not be absolutely reliable. It is asked that full and specific accounts of failure or apparent failure of any of the illustrated articles should be at once forwarded to the laboratories. This seems to us to be an excellent method of eliminating faulty apparatus, or weak points in good apparatus. The articles illustrated range from the Edison screw plug to distributing boxes, or panel boards, and include switches of various types, insulators, sockets, starting switches and rheostats, fuses of various patterns and conduits. Some of these would certainly not be approved in England; that is to say, they would not pass the insurance or Institution requirements. We may refer specifically to the switches shown. We notice that the open-type knife-pattern switch, single, double and three-pole, in which the whole of the contacts and working parts are exposed, is illustrated as suitable for 500-volt circuits. Some of the rules themselves appear to enter into unnecessary detail, and are calculated to lead to considerable argument between users and inspectors. Thus, under "Motors," we read that variable-speed motors, unless of special and appropriate design, if controlled by means of field regulation, must be so arranged and connected that they cannot be started under a weakened field A great deal, of course, depends upon the interpretation of "special and appropriate design," and the speed range by shunt control also should be taken into account, as any standard motor will start under any conditions of field if the speed range is not more than, say, about 50 per cent. There is no doubt, however, that the rules are very comprehensive, and the illustrations given are very useful, helping contractors to grasp the intention of the requirements.

The Slide Rule. By R. G. Blaine, M.E. London: E. & F. N. Spon. 1907. Price 2s. 6d.—This is the third edition of Mr. Blaine's handbook on quick and easy methods of calculating; the use of logarithms is first explained in simple language, and is followed by a detailed account of the slide rule and its uses. Circular rules and the Fuller rule are also dealt with, and numerous examples of practical applications to every-day problems are given. The new edition includes Prof. Perry's log-log rule, new cursors, &c., and a set of four-figure logs and antilogs.

Journal and Record of Transactions of the Junior Institution of Engineers. Vol. 17. Session 1906-7. Edited by W. T. Dunn. London: P. Marshall & Co. 1907. Price 10s. 6d.—This volume contains, amongst other papers, "The Protection of Inventions," by B. E. D. Kilburn; and the "Theory of the Steam Turbine," by H. M. Martin and R. H. Parsons.

"Steam Boilers, Turbines and Engines." By S. F. Walker. London: Harper & Bros. 1908. Price 9s. net.

"The Hughes and Baudot Telegraphs." By A. Crotch. London: S. Rentell & Co., Ltd. 1908. Price 1s. 6d. net.

"The Week-end & Holiday A.B.C." February, 1908. London: Week-end & Holiday A.B.C. Price 6d. net.

"The Engineer's Year Book, 1908." By H. R. Kempe. London: Crosby Lockwood & Son. Price 8s.

"Annual Report of the Smithsonian Institution for the year ending June 30th, 1906." Washington: Government Printing Office, 1907.

"Subject Matter Index of Mining, Mechanical, and Metallurgical Literature for 1902." Edited by M. Walton Brown. Newcastle: North of England Institute of Mining and Mechanical Engineers. 1907. Price 42s.

"Victoria and Albert Museum: Topographical Index to Measured Drawings of Architecture." London: Wyman & Sons. 1908. Price 1½d.

"Science Abstracts," January 30th. Vol. XI. Part 121. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. per section.

"Science Abstracts." Index to Vol. X. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. per section.

Robertson Glassworks.—As our readers are aware, a great deal of glasswork is imported into this country, and some of our lampmakers have made more or less heroic efforts to alter this state of things. A great deal of their glass is, however, still purchased abroad. We learn with interest that the ROBERTSON ELECTRIC LAMPS, LTD., have acquired the glassworks of George Sowerby at Lemington-on-Tyne, and that all their glass is being made there.

Marseilles Exhibition.—We are informed that entries for the above Exhibition can be received till the end of February.

Electric Signs.—THE TECHNICAL ART CO., of Emerson Chambers, Newcastle-on-Tyne, have sent us a leaflet concerning a line of electric signs that they are introducing, in which the problem of electric sign work has been considered from the advertising rather than from the engineering point of view. One of these devices is the duplex flashing cone sign, another the automatic thermo-electric cone sign. A specially-devised switching arrangement has been introduced for giving cyclic operations at a lower cost than by motor drive. The signs and this device are all provisionally protected. Messrs. Jarvis Bros., Ltd., of Middlesbrough, are the sole selling agents for the Technical Art Co. for these signs.

Exhibition.—The Permanent Inventors' and Manufacturers' Exhibition, of Carlton House, Regent Street, Waterloo Place, London, S.W., have opened a permanent exhibition of models, drawings, &c., of inventions and manufacturers' samples which will be shown, explained, sold, or otherwise dealt with, on terms and conditions which are set out in a prospectus which is now in circulation.

Trade Announcements.—MESSRS. HUNTALITE, LTD., recently removed to more commodious premises (showroom and registered offices) at 23, Newman Street, Oxford Street, London, W. They now hold larger stocks of the Huntalite candle lamps for all voltages. A display of various types can be seen in the new showroom.

We are informed that the gas department of Bruce Peebles & Co., Ltd., has been transferred to a private limited company under the style of PEEBLES & Co., LTD. All letters in connection with the gas business have to be addressed in future to Peebles & Co., Ltd., Tay Works, Bonnington, Edinburgh, instead of to Bruce Peebles and Co., Ltd. There will be no change in the active management, as Mr. Carmichael Peebles remains as managing director, and Mr. George King Grieve as manager. The new company will collect the debts due to, and discharge the liabilities of, the gas department.

MR. R. G. THOMSON and MR. A. RAMSAY have commenced business as consulting, electrical, mechanical and ventilating engineers, under the name of Thomson & Ramsay, at Castle Chambers, 55, West Regent Street, Glasgow. They invite manufacturers to forward copies of latest catalogues and price lists.

MESSRS. CECIL HODGES & Co., late of Finsbury Pavement, have moved their offices to the works, at Snowdon's Wharf, Millwall, E., where all communications should be addressed. In order to save delay, readers are asked to take note that the company has now no office or representative in the City.

MESSRS. NURSEY & MARR, mechanical and electrical engineers and contractors, of 53, Victoria Street, S.W., have, as a new development of their operations, opened a merchant and engineering business with the Far East with representatives at offices in Shanghai, Tientsin and Vladivostock. The firm's main line of business in this country is electrical contracting, but they are also agents for three firms, namely: James Carter & Sons, of Stalybridge, manufacturers of fuel economisers, overhead travelling cranes and general engineering work; Brown's Foundry Co., of Derby, manufacturers of castings of all kinds; and H. H. Böker & Co., of Rhemschied, who make tramway material of all kinds, tires, wheels, &c. Mr. Cyril F. L. Nursey is a son of the late Mr. Perry F. Nursey, who was so well known for a very long period in the engineering and journalistic world. Messrs. Nursey & Marr invite firms who have not already done so to send them catalogues of their manufactures.

The business of the late MR. E. J. PHILPOT, electrician and electrical contractor, 34, St. George's Street, Canterbury, and 91, High Street, Ramsgate, will be continued by the executors.

MR. CHAS. V. FISHER, electrical engineer, has changed his address to more central premises at 11, High Street, Doncaster.

Nernst Lamps.—We are informed by THE A.E.G. ENGLISH MANUFACTURING CO., LTD, 4-5, New Compton Street, Charing Cross Road, London, that the life of Nernst burners has been considerably increased of late. From Frome records have been received which show an average life of 619 hours, up to December 31st, 1907. Again, Chester has about 160 lamps installed, and the records of burners renewed from November 1st to December 31st, 1907, show the average life to be well over 800 hours. Out of 171 burners, 61 burnt over 1,000 hours, and only nine failed to give a life of over 200 hours, so that it is claimed that premature failure is overcome and short-lived burners are a thing of the past. These results were obtained under the following conditions:—

1. Lamps used for street lighting.
2. Burning hours about 3,518 per annum.
3. New type cut-out coils fixed.
4. Polarity strictly observed.
5. Combination matched according to actual, not nominal, voltage.

The actual records can be seen at any time at the office of the company, who will be glad to place their experience at the disposal of any reader who is not obtaining good results.

High-Tension Switchgear.—MESSRS. A. REYROLLE AND CO., LTD., Hebburn-on-Tyne, have during recent years been engaged upon designs for the above, and have manufactured a large quantity of apparatus for the supply companies in Northumberland and Durham. Their time has up to now been fully occupied by these companies' requirements, but as they have recently made further facilities in their works for the production of this apparatus, they are now in a position to supply the apparatus outside this area. The designs include a complete system of high and low-tension switchgear up to 10,000 volts, and the protective gear embodies the "Merz-Price" system. When applied to feeder protection any faulty section upon a power transmission scheme will be automatically isolated without interference with sound sections upon the same system. The protection covers any system of high-tension network, including ring mains, loops, tees, multiple feeders in parallel, &c. The "Merz-Price" system also includes devices by which any faulty transformer will be automatically isolated from a bank of transformers without interference with any other transformer. We understand that the company have up to date equipped sub-stations with about 200 1,000-KW. panels, and that many of these have been in use during the past two years.

"Oriflamme" Lamps.—THE OLIVER ARC LAMP, LTD., have recently received orders for their "Oriflamme" lamps from the Admiralty, for H.M. Dockyard, Devonport (Keyham extension); Haulbowline Dockyard; London and North-Western Railway, for Crewe (37 lamps); and from the Portsmouth Corporation, extension order for 25 lamps for street lighting. We are informed that all the flame lamps in Cannon Street for the experimental City lighting are now of the "Oriflamme" type.

Incandescent Lamp Tests.—We are informed that the Westminster Electrical Testing Laboratories have just completed a series of tests on most of the principal makes of incandescent lamp, some 12 in all; six lamps were tested of each make, three being purchased in November and the remainder three weeks later, the object being to avoid obtaining all six lamps out of one day's make. The lamps were all purchased over the counter, the sellers having no opportunity to supply picked lamps. The lamps were ordered to be 200 volts, 16-c.p. and of ordinary efficiency. They were run on life test for a period of 500 hours, at a pressure of 200 volts, maintained constant to within ½ per cent. by means of an automatic regulator, and were tested for mean spherical candle-power (the only really fair comparison) watts and watts per candle-power at start, and at intervals of 100 hours up to 500. The results of the test have been printed in full and bound up in one leather-covered volume: the subscription required to obtain one copy of the report is £2 2s., and additional copies will be supplied if required at £1 1s. each, upon condition that they are not resold.

Dinner.—On Saturday, February 1st, 36 members of the Manchester staff of Messrs. S. H. Heywood & Co., Ltd., gathered for their first dinner and musical evening, at the Bull's Head Hotel, Market Place. The toast of the evening, "Success to the Firm," proposed by the chairman (Mr. C. E. Hooley), was followed by a flashlight photograph of the company. A musical programme followed.

The Wolfram Lamp Factory at Brook Green.—The Wolfram (Tungsten) Metal Filament Lamps Ltd., who, in conjunction with the Robertson Electric Lamps, Ltd., and the General Electric Co., Ltd., are erecting a factory at Brook Green, Hammersmith, have received the following tenders:—

Hughes & Stirling	£41,688
Roome & Co.	39,686
Wisdom Bros.	39,408
Spencer, Santo & Co., Ltd.	39,377
John Allen & Co.	38,265
J. Chessum & Co.	37,892
Trollope & Colls	37,587
Barnett & Brotchin	37,510
Walkerdine	36,939
Waring, White Building Co.	35,978
Henry Lovatt, Ltd.	34,832
John Carmichael	34,456
John McManus	34,400

The tender of Mr. McManus, of Hammersmith, has been accepted, and the work is now in progress. The architect who prepared the plans, and under whose supervision the buildings are being erected, is Mr. Richard J. Lovell, 46, Queen Victoria Street, London, E.C.

Cylindrical Grinding.—A pamphlet under this title comes to hand from Messrs. Ludwig Loewe & Co., pointing out the possibilities of grinding as applied to machine shop work, the nature of the wheel to be used, the question of wet or dry work, peripheral speeds, materials to be ground, and so on. A tabulated list of specimen illustrations is given to furnish information as to the time taken to do certain work on a number of specimens. A table of approximate values of millimetres and inches concludes a useful little pamphlet.

Dissolutions and Liquidations.—"Z" Electric Lamp Syndicate, Ltd.—This company is winding up voluntarily, and agreements have been entered into for the registration of a new company under the name of the "Z" Electric Lamp Manufacturing Co., Ltd. Creditors must send particulars of debts, &c., to the liquidator, Mr. H. J. Owens, Orient House, New Broad Street, E.C., by March 2nd.

Wolfram, Ltd.—A meeting is to held at 8, Laurence Pountney Hill, E.C., on March 2nd, to hear an account of the winding up from the liquidator (Mr. Wm. Barton).

Messrs. Baxendale Bros., Whitechapel, Liverpool, electrical and sanitary engineers.—Messrs. W. J. Baxendale, G. G. Smith, J. Gray and D. Baxendale have dissolved partnership, Messrs. Smith and Gray retiring. The two remaining partners will continue the business under the same style.

The "Engineering Times" Co., Ltd.—A meeting is to held on March 7th at 6, Bouverie Street, E.C., to hear an account of the winding up, from Mr. B. Marwood, liquidator.

Messrs. Wm. Baker & Co., electric lighting engineers, 3, Mulgrave Road, Sutton.—Messrs. A. Bennetts & W. Baker have dissolved partnership. Mr. Bennetts attends to debts.

Bankruptcy Proceedings.—Sidney W. Atherton, company promoter, Hurst Park, Prescot.—According to a notice in the *London Gazette*, the receiving order of September 10th, 1907, was discharged on December 6th, 1907, the Court having approved the terms of composition submitted by the debtor (7s. 6d. in the £ in three instalments, 2s. 6d. at once, 2s. 6d. in three months, and 2s. 6d. in six months, payment to be secured by a sum of money deposited with the Official Receiver, to cover the first instalment, the second and third being secured by the promissory notes of Mr. Jacob Atherton).

Brown, Boveri Italian Works.—Messrs. Brown, Boveri & Co., Ltd., of Westminster, inform us that their Italian house, "The Tecnomasio Italiano Brown-Boveri," has lately amalgamated with Messrs. Gadda & Co., who were formerly their most important Italian competitors. In the future Messrs. Gadda will not manufacture electrical machinery, but will confine themselves to contracting for electrical plants and their management. Messrs. Gadda have bound themselves to buy from the Tecnomasio Italiano Brown-Boveri all the electrical material they—or their sub-contractors—may require. The Tecnomasio Italiano Brown-Boveri, will take over Messrs. Gadda's works at the Via Castiglia, Milan which employ about 1,000 workmen, and are equipped with the most modern tools and machinery. The old works of the Tecnomasio Italiano Brown-Boveri in the Via Pace will be shut down and handed to Messrs. Gadda for sale. The erection of the new works of the Tecnomasio at the Porta Romana, which were started some time ago, will now be held back till required. After the completion of these new works, which will allow of a considerably increased output, the Tecnomasio intend to abandon the Via Castiglia works and to remove entirely to the Porta Romana. We learn that the capital of the Tecnomasio Italiano Brown-Boveri is to be increased shortly to 6 million lire (£240,000). The Baden house intends to subscribe such a proportion of this increase as will enable the A. G. Brown, Boveri & Cie. to hold half the entire capital. Both the technical and commercial management of the Tecnomasio Italiano Brown-Boveri will remain in their hands.

LIGHTING and POWER NOTES.

Aberdeen.—The city electrical engineer has valued the Deeside electricity undertaking as a going concern at £6,137, excluding the cost of the company's prov. order or flotation of the company. The nominal capital of the company was £10,000, and £9,842 had been spent. The undertaking, as taken over by the Corporation, had 141 consumers.

Ashford (Kent).—The B. of T. has revoked the 1904 E.L. order.

Aston.—The Electricity Committee is recommending a scheme for the extension of the electricity works, and proposes that a loan of £25,213 shall be applied for to carry out the work.

Barnstaple.—The T.C. has decided to establish a showroom for electrical fittings and apparatus at the electricity works. There was some opposition to the proposal when the matter came before the Council on January 28th, on the ground that the showroom would interfere with the trade of the town, but it was explained that goods would only be shown and not sold.

Brierley Hill.—The B. of T. has informed the U.D.C. that it has deferred consideration of the question of revoking the E.L. Order until the end of 1908.

Burnley.—The Electricity Committee has recommended the T.C. to increase the plant at the electricity works by a 750-kw. steam dynamo and a motor-driven centrifugal pump, at a cost of £7,100.

Bury.—The Electricity Committee has recommended the T.C. to apply for sanction to borrow £72,000 for the erection of the new electricity generating station at the Chamber Hall.

Clacton-on-Sea.—A recommendation from the Electricity Committee that the plant at the E.L. works should be increased at a cost of £4,000, was, on January 29th, deferred for fuller particulars to be furnished by the engineer. It was stated that the additional plant was absolutely necessary in order to cope with next season's demand.

Continental Notes.—Germany.—Plans are being prepared in respect of a projected electricity generating station which is to be established in the town of Herford, Westphalia, to supply energy for lighting and power purposes to a number of towns and villages in the district.

An electric lighting and power plant is being established in connection with the collieries of the Paulus Colliery Co. at Morgenroth.

Italy.—Engineer Calatroni, of Cremorne, has recently published a report of his investigations concerning the possible appropriation from the River Po of water-power of 53,000 h.p. to 70,000 h.p. for the supply of electric power in the province of Plaisance.

A Commission of the Communal Council of Milan has authorised the expenditure of about £524,000 on the construction of a hydro-electric installation in the Valteline, the water-power to be derived from the River Adda and from the torrent Roasco, with a view to the production of electric power for the public services of the city of Milan.—*Board of Trade Journal.*

Much opposition has been aroused in artistic circles by a proposal of the Municipality of Venice to light the town and incidentally the canals by incandescent electric lights.

Colne.—The T.C. has decided to apply to the L.G.B. for sanction to borrow several loans:—£1,670 for a high-tension cable, &c., £1,000 for extensions to mains and £1,500 for hiring motors.

Croydon.—The B.C. decided on Monday to apply to the L.G.B. for sanction to a loan of £13,500, being the Lighting and Electricity Committee's estimated expenditure to March 31st, 1910, divided as follows:—New mains, £10,000; services, £2,700; transformers, £250; sub-stations, £550. The Council has decided to oppose the London Electric and London and District Electricity Supply Bills.

Dunfermline.—The T.C. has agreed to ask Sir A. B. W. Kennedy to negotiate with the managing director of the Fife Electric Power Co., in order to ascertain the best terms which could be had for the Council's provisional order, following upon the proposal to hand over the order to the company.

Eastbourne.—The Electricity Committee of the T.C. has declined to support the proposal of Hastings T.C. that the B. of T. be asked to introduce a Bill enabling local authorities to carry out E.L. wiring and the supply of electrical fittings.

Epsom.—On January 30th an official opening of the recent extensions to the electricity works took place—the opening being followed by a dinner. The extensions include a 300-kw. Browett-Lindley-E.C.C. direct-current steam generator, together with a Worthington condenser; also a Stirling boiler. The proceedings passed off most satisfactorily.

Finchley.—On January 30th a L.G.B. inquiry was held into the application of the U.D.C. for sanction to borrow £22,000 for electric lighting. There was no opposition.

Greystones, Co. Dublin.—A meeting of the ratepayers of this township was held on the 1st inst. for the purpose of considering three schemes of lighting for the town. The schemes included an electric lighting one by Messrs. William Coates and Co., Belfast and Dublin; a coal gas scheme by a London firm, and an improvement on the present oil lamp system. Messrs. Coates's scheme included 70 standards with two lamps on each for public lighting, plant would be laid down for supplying private lighting, and the cost would be about £3,000. It was decided to approve of the electric lighting scheme, and to oppose the Gas Bill which is being promoted in Parliament.

Grimsby.—On the advice of the electrical engineer, the E.L. committee has adopted the I.E.E. standard wiring rules for all installation work.

Heywood.—The Corporation Electricity Committee has decided to extend the electricity works at an estimated cost of £8,000.

India.—A complete scheme for the East India Railway Co.'s offices at Howrah, involving the installation of 125 fans and about 300 lights, has now been approved.

London.—Paddington.—Recently a number of the Metropolitan B.Cs. wrote to the B. of T. protesting against the reported decision of the Board to abolish official audits of the accounts of electric lighting undertakings. The Paddington Council has now received a communication from the Board, stating that it is not proposing to abolish the official audit of the accounts of electric lighting companies having powers under the Electric Lighting Acts, 1882 to 1890.

Fulham.—The town clerk has sent a circular letter to the various Metropolitan Borough Councils, inquiring whether they favour the suggestion that the London local authorities owning electricity undertakings should co-operate with the London electric supply companies in arranging for a collective exhibition or demonstration of electricity at the Franco-British Exhibition.

The Thames Conservancy has decided that clauses protecting its interests should be inserted in the various electricity and tramway Bills in its area to be presented before Parliament.

Stepney.—The B.C. has decided to oppose the London Electric and London and District Electricity Supply Bills.

Long Eaton.—A L.G.B. inquiry was held on January 31st into the application of the U.D.C. for a loan of £10,000 for electricity purposes, viz., for plant and cable extensions. There was some objection on the ground that the lace trade, the staple industry of the town, was very much depressed.

Loughborough.—It has been decided by the T.C. to apply to the L.G.B. for sanction to borrow £5,000 to meet future expenditure on the electrical undertaking.

Mytholmroyd.—The B. of T. has revoked the 1902 E.L. order.

Newport (Mon.).—The Corporation Electricity Committee has resolved to appoint a canvasser with the object of securing additional consumers.

Queenborough.—The laying of mains at Queenborough by the Sheerness E.L. Co. has been completed, and a supply of electricity is now available in the area.

South Shields.—A L.G.B. inquiry was held on January 29th into the applicatson of the T.C. for a loan of £7,052 for electricity purposes, principally for additional plant. There was no opposition.

Stoke-on-Trent.—The T.C. has decided to apply for a loan of £5,965 for additional generating plant.

Surrey.—The County Council has given notice of its intention to oppose the following Bills:—Croydon and Southern District Tramways; London and District Electricity Supply; London Electric Supply; London United Tramways and West London, Barnes and Richmond Tramways.

Walthamstow.—The district auditor (Mr. D. H. Boggis Rolfe) has recently issued a lengthy report, severely criticising the method of keeping the electric lighting and tramway accounts.

Wath-upon-Dearne.—The B. of T. has revoked the 1899 E.L. order.

Wednesbury.—An unpleasant state of affairs exists here at the present time between the Midland Electric Corporation for Power Distribution, Ltd., and the Corporation, arising out of the electric lighting order of the company. Friction, as a matter of fact, has been experienced for some time, but it has now become acute. The main facts may be gathered from a report which has been issued by the Lighting Committee of the Corporation, in which it is stated that, at the request of the Board, a meeting was held at the offices of the Board of Trade on January 7th between representatives of the Midland Electric Co. and representatives of the Corporation, to see whether it would not be possible for some new arrangement to be made for the supply of energy in bulk by the company to the Corporation. The terms submitted by the company at the meeting, and further terms since obtained from it have been carefully considered by the Committee, and the latter is of opinion that they would not enable the Corporation to carry on the electricity undertaking except at a loss. The Committee has since received a notice from the company of its intention to terminate on March 31st the agreement for the supply of electricity in bulk to the Corporation; and also a further notice of intention to break up all the principal streets of the town in pursuance of the powers alleged to be contained in the provisional order. Notice of the Corporation's disapproval of the company's proposed action has been served on the company. Here, then, is all the evidence of plenty of work for the lawyers. Meanwhile, there is active canvassing by the company and by the Corporation for customers. The latter claims that its terms will be equally favourable with the terms of the company, and in a circular which the Corporation has issued it is pointed out: "There is not room in the borough for two successful electrical undertakings, and priority should be given to that one in which the ratepayers are interested. The success of the Corporation undertaking," it is added, "will result in a reduction of the rates. The Birmingham Gas Department, which controls the local gas supply, has also entered the lists as an active competitor against the company and the Corporation, claiming that gas is preferable to electricity for both lighting and power purposes, and also cheaper.

Wimbledon.—The question of placing the sewage works, where the machinery is electrically-driven, under the control of the electrical engineer, is being considered by a sub-committee.

The E.L. Committee has agreed to accept £2,015 from the London United Tramways Co., for work done in connection with the local routes.

Worcester.—A L.G.B. inquiry was held on February 4th into the application of the Council to borrow £10,000 for electrical extensions. It was mentioned that the immediate extension was only a small one, and the Inspector advised that only the amount required for that extension would be sanctioned in the present instance, and the rest at a later date.

Wrexham.—The T.C. has received sanction for a loan of £575 for electricity purposes.

It has offered to supply energy to the Great Western Railway Co. on the following terms:—For an annual consumption of 15,000 units or under, £165; above 15,000 units up to 20,000 units per annum, 2½d. per unit; beyond, 2d. per unit.

York.—The Corporation Electricity Committee has decided to undertake the hiring-out of arc and Osram lamps, and the installation of the E.L. at consumers' premises on a deferred payment system.

TRAMWAY and RAILWAY NOTES.

Accrington.—The General Works Committee has agreed to take over the supervision, maintenance, and repair of the tramways, the cost thereof to be chargeable to the Tramways Department.

Birmingham.—On Saturday last a car on the Lodge Road route, when proceeding along Summer Lane, ran away, jumping the track and colliding with the kerb at the side of the road. Fortunately the occupants of the car sustained no serious injury.

Blackburn.—The Corporation tramways for the nine months ended December 31st show a total expenditure of £28,492; receipts, £47,424, averaging 13·42 per car-mile; and after payment for loans, interest, &c., a net profit remains of £3,363.

Burnley.—The T.C. has been recommended by the Tramways Committee to purchase five additional cars similar in design to those recently put into use on the Manchester Road service. The cost is estimated at £800 each.

Canada.—Material progress is being made with the organisation of the English company which is to develop Canada's electrical railways, and which undertakes to spend some £2,000,000 upon the work. The company proposes to construct electric railways in the rural districts of Ontario, improve and develop certain existing water powers, and to lay down railway lines on the Island of Montreal. In the course of the operations it is intended to take the Toronto Street Railway in hand and greatly improve it.

Colne.—At the T.C. meeting on January 30th, correspondence with the Colne and Trawden Light Railway Co. *re* matters in dispute was submitted, and it was agreed that the services of an arbitrator should be solicited. The dispute is a question of principle regarding the repair of the roadway just outside the Light Railway's track.

Continental Notes.—FRANCE.—It has been decided to abolish the steamboat service on the left bank of the Seine owing to the competition of electric tramways and railways on that side of the river.

MADRID.—A concession has been granted for the construction of an electric tramway between Mediodia and the north station at Madrid.

ITALY.—A company has lately been formed in Pisa with a capital of £120,000 and the title La Società per la Tramvie Elettrica Viareggio-Marina di Carrara, to construct and work an electric tramway between the places named.

AUSTRIA.—A public electric motor-car service is about to be established between Weidling and Klosterneuburg, a distance of 4½ kilometres. The line will be on the railless trolley system, that is to say, the vehicles will run on the ordinary road and take their energy from overhead conductors. Three cars have already been ordered for the line from the Austrian Daimler Motor Co., of Vienna.

Croydon.—The B.C. resolved on Monday to oppose the Croydon and Southern Districts Tramways Bill, strong objection being taken to the desire of the promoters to obtain running powers through the borough; also the L.C.C. (Tramways and Improvements) Bill, in this case to endeavour to secure a widening of the bridge over the River Graveney at Norbury, where the proposed terminus of the Streatham extension will come to within a few feet of the Croydon tramways terminus.

Glasgow.—An inquiry was held on January 23rd before Sheriff Moncrieff and a jury into the deaths which occurred at the recent runaway tramway accident. Most of the evidence was a repetition of that given at the B. of T. inquiry, and the jury in returning a verdict of "Accidental Death" added its opinion that the car should not have been utilised except with the controller reversing handle in normal use.

Gorton.—The B. of T. has notified the U.D.C. of its sanction to the borrowing of £11,350 to defray the expenditure on electric tramways connecting Stockport with Reddish, Gorton, and Openshaw by circular route.

Halifax.—Major Cardew and Mr. H. Graham Harris proposed to open their inquiry yesterday as to the working of the electric tramways with a view to making suggestions, where desirable. They have agreed with the Tramways Committee as to the procedure to be adopted in holding the inquiry.

Liverpool.—The income of the Tramways Committee during the year ended December 31st last was £583,057, of which £572,822 was traffic revenue, £7,389 revenue from advertising, £1,000 electric supply account, £605 rents, and £1,240 miscellaneous. The total expenditure amounted to £398,734, made up of £151,895, traffic expenses; £55,574, general expenses; £83,773, general repairs and maintenance, and £107,491, power expenses. The balance carried to net revenue account was £184,323. Other items of income on this account bring up the total to £199,631. This was disposed of by the payment of £53,059 interest; £5,891 rent on leased lines; £54,276 payments to sinking funds; £3,026 repayment of loans; £27,793 contribution in aid of general rate; and £55,586 payments to reserve, renewal and depreciation account.

London.—L.C.C.—At the meeting on Tuesday the Highways Committee presented a report on the proposed reconstruction on the overhead trolley system of the tramways from near Brixton Road, *via* Gresham Road and Coldharbour Lane to a point near Camberwell Green. The total length amounts to about 1¼ route miles, and the estimated cost of reconstruction and equipment was £27,160. The consideration of a recommendation to sanction this expenditure was adjourned for a week.

HAMPSTEAD COLLISION.—The B. of T. report on this collision, which occurred on October 26th between two electric trains at West Hampstead station, lays full responsibility for the accident on Signalman Hollis, through his forgetfulness, and draws attention to the fact that illegal manipulation of the electrical instruments in the box had occurred.

Manchuria.—The contract for electric trolley tramways and electric lighting at Vladivostok, at some £158,000, has been given to a German firm.

Mexico.—A contract has been entered into by the Compania del Ferrocarril Eléctrico de Lerdo á Torreon for the construction of a line between the States of Durango and Coahuila.

North Staffordshire.—Strong local feeling has been aroused in Hanley, Fenton and Stoke by the action of the Potteries Electric Traction Co. in increasing workmen's fares and the price of weekly tickets, and curtailing the hours during which they are available.

Rowley.—The District Council has asked the Birmingham and Midland Tramways Co. to confer with it on the subject of ½d. fares, and the provision of a more frequent service of cars between Old Hill and Black Heath.

South Shields.—The Tramways Sub-Committee has reported to the T.C. that the condition of the tramway rolling stock is not such as to be dangerous to the public; it considers, however, that it is advisable that the car-shed superintendent should resign his position.

Sunderland.—The Tramways Committee has just adopted the estimates for the half-year ending March 31st, 1908. The income is estimated at £71,287, including £70,000 for traffic receipts; the actual income for the corresponding half-year of 1907 was £73,340, of which £72,054 was from traffic receipts. The expenditure for the coming half-year is estimated at £66,999, against a corresponding expenditure of £66,216. There will probably be £4,288 available for the relief of the rates, compared with £7,124 last year. The principal items of expenditure estimated for were:—Traffic expenses, £18,959 (including £13,100 wages of motormen and conductors); salaries of general officers and staff, £1,100; and rates, £2,800. The cost of energy was put at £12,840, and of general repairs and maintenance £4,110. A sum of £6,200 was allowed for the reserve and renewals fund.

TELEGRAPH and TELEPHONE NOTES.

Baudot System.—It is announced by the Courrier des Examens that Mr. Beugin, an employé of the Central Telegraph office at Paris, is endeavouring to simplify the Baudot apparatus. Trials have been successful.

Sahara.—A scheme has been prepared for the construction of a telegraph line across the Sahara desert. A line already exists between the towns of Oran and Beni Abbès, and between Algiers and Timmimonu; one or other of these will be carried on to Adrar, 745 miles from the Mediterranean, and from there to Bourren, 869 miles distant. From Bourren, branches will be carried to Timbuktu, joining the Senegal line, and to Say, communicating with Zinder and Lake Tchad, thus bringing the Sudan, Dahomey and the Ivory Coast into connection with Algiers. The cost is estimated at £100,000, and the duration of the work at 18 months.

St. Petersburg.—Reuter reports that Heissler's telephone manufactory has been burnt, and 20,000 telephone instruments, which were intended for the telephone service of the city, have been destroyed.

Telegraphic Interruptions and Repairs:—

CABLES.		INTERRUPTED.	REPAIRED.
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo	Closed..	Jan. 19, 1906 ..	..
Tarifa-Tangier		Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed) ..		Mar. 9, 1904 ..	..
Scotland-Orkney and Shetland Islands ..		Jan. 2, 1908 ..	Jan. 31
Bathurst-Bissao		Dec. 25, 1907 ..	..
Paramaribo-Cayenne		Jan. 11, 1908 ..	..
Cayenne-Salinas		Jan. 14, 1908 ..	..
Teneriffe-St. Louis du Senegal		Jan. 16, 1908 ..	Jan. 28
Trinidad-Demerara		Jan. 25, 1908 ..	Jan. 28
Cayenne-Brazil		Jan. 27, 1908 ..	..
Alexandra-Larnaca		Jan. 28, 1908 ..	..
Perim-Djibouti		Jan. 29, 1908 ..	Jan. 30
LANDLINES.			
Puerto-Barrios		Aug. 3, 1909 ..	..

Telephone Charges.—A deputation from Chambers of Commerce and municipal authorities is to be received by the P.M.G. on Tuesday next, the 11th inst., on the subject of telephone rates.

Telephone Enterprise.—It is reported that the Associated Swedish, Danish and Russian Telephone Co. has increased its share capital by £400,000. The proposal is to link up St. Petersburg, Moscow, Warsaw, Copenhagen, Stockholm, Berlin, Christiania, Frankfort and Paris by telephone in the course of this year.

Wireless Telegraphy.—As previously mentioned, the German Government has prepared a Bill to amend the Telegraph Act of 1892, so as to control wireless telegraphy in that country. The Bill, which was laid before the Imperial Parliament on January 21st, was referred to a committee of 14 members for consideration, and in a speech delivered on that occasion, Herr Kratke, Secretary of State to the Imperial Post Office, stated that the incentive for the Bill arose from the development of wireless telegraphy for practical purposes. It was necessary to amend the Act in the first place for the purpose of the interior, because they were compelled to take up cautiously the development of wireless telegraphy for the defence of the country, and for the Navy and mercantile marine; and, secondly, in order to observe international conventions. The method possessed many defects, because the waves sent through the other set in operation all other stations attuned to the same waves. By that means stations could pick up telegrams which were not intended for them, and they could also disturb the waves in the air and cause the telegrams to be mutilated. Both those circumstances rendered it necessary to introduce legal regulation. According to Sec. 3 of the Telegraph Act, telegraph installations are in general under the scope of the Empire, although exceptions

exist which enable telegraph stations to be erected without the consent of the State. Doubts also arose as to how far the Telegraph Act applied to the mercantile marine, and that also necessitated legislation. Other difficulties had arisen in the sense that individual foreign companies had taken up the attitude that ships equipped with their apparatus should only communicate with vessels fitted with apparatus on the same system. At the international conference in 1906 an agreement was arrived at, that each ship must enter into communication with a coast station without regard to the kind of apparatus used, either at the shore station or on board the vessel. The Bill was also necessary on that account, in order to carry out the international agreement. After various members had expressed their approval of the general objects of the measure, Dr. Delbruck remarked that there were 1,500 wireless telegraph stations in the world; 44 per cent. were arranged on the Telefunken system, and 22 per cent. according to that of Marconi.

New Wireless System.—The invention of a new system of wireless telegraphy with continuous waves is attributed to Egbert von Lepel, of Berlin, and a successful demonstration of its use was recently given between Reinickendorf, near Berlin, and Brunswick, a distance of 142 miles. It is stated that the essential characteristic of the generator is represented by an entirely new kind of electric discharge between metallic electrodes, and that for a given output it only weighs about one-tenth as much as the Poulsen apparatus, and is more economical in the consumption of energy. It is proposed to make experiments over a greater distance in the near future, and also to make more extensive tests with the same system in connection with wireless telephony. The inventor, who is only 26 years of age, was formerly a lieutenant in the army, was employed as an erector by the Allgemeine Co., and was afterwards engaged as an engineer by the Berlin Wireless Telegraphy Co. He was employed by the latter on the staff of Admiral Rozhdestvensky during the Russo-Japanese War, and had the honour of submitting technical reports to the German Emperor and of receiving his Majesty's written acknowledgments. Herr von Lepel has more recently conducted experiments in his own laboratory with a new kind of receiving apparatus for wireless messages, and carried out the work in connection with his new system for the production of undamped oscillations.

On Monday last Marconi's Wireless Telegraph Co. opened their system for the transmission of public messages between London and Canada, at a charge of 7½d. per word, inclusive of land charges. Messages have to be handed in at the office of the company, Watergate House, York Buildings, Adelphi.

The Diplomatic and Consular report for Cuba for the year 1906 states that a new wireless telegraph station at the Mores, Havana, has just been completed, the tower having an altitude of 75 metres. A new station has also been constructed in Santa Clara, and stations are in course of construction at Camagnez and Santiago de Cuba.

In the House of Commons on Wednesday the P.M.G. stated that the Wireless Telegraphy Convention would have to be ratified by the Government, and notice of the reservation of the right of exemption of stations given, before the end of March. The United States have postponed ratification indefinitely.

CONTRACTORS' COLUMN.

Openings for New Business.

AINSDALE.—House in Southern Road for T. S. Hatch.

ALDERSHOT.—New Council schools at Ash for Surrey C.C. (£4,220). Martin, Wells & Co,, builders, Victoria Road, Aldershot.

ASHTON-IN-MAKERFIELD.—Showrooms and workrooms in Princess Road for J. Ince.

New wash-houses for Lord Gerard.

ASHTON-UNDER-LYNE.—Place of worship in Old Street. J. Robinson, builder, Ashton-under-Lyne.

BALDOCK (Herts).—Hostel for R.C. religious order (£4,164). Underwood and Kent, architects, 19, Leys Avenue, Letchworth, Herts; S. Redhouse & Son, Stotfold, builders.

BARNSLEY.—New laundry at the Beckett Hospital for the governors. Senior and Clegg, architects, 15, Regent Street, Barnsley.

BARNSTAPLE.—Houses in Granville Avenue for J. Wakeley, and houses in Charles Street for E. Karslake.

BEDFORD.—Houses in Dudley Street. Geo. Williamson, builder, 6, Dudley Street, Bedford.

Houses in Golding Road. A. W. G. Prosser, architect, 90, Kimbolton Road, Bedford.

BIRKDALE.—Two houses in Bedford Road, and two in Langford Road for R. Bolton.

BIRKENHEAD.—Extension of the pier and floating stage at Egremont for Wallasey U.D.C. (£17,000).

BIRMINGHAM (Handsworth).—New cemetery chapel (£5,000) and registrar's house on Leverett's estate. W. H. Bidlake, architect, Birmingham.

Proposed rifle club premises in Imperial Arcade, Dale End. Councillor Bowater, chairman of sub-committee.

Renovation and enlargement of the Islington Wesleyan Church, St. Martin's Street, including new senior school and institute. Rev. J. J. Leedal, minister.

New secondary school and pupil teachers' centre for the Education Committee.

BLACKPOOL.—New Wesleyan Church. Kelvey & Penlington, architects, St. Anne's.

20 houses in Gloucester Avenue for H. Rose and B. Smith; two houses and shop in Hawes Side Lane for J. Boardman; three houses in Grosvenor and Charles Streets for Collins & Co.; three houses in Roseberry Avenue for J. J. G. Hall; and six houses for W. Wild.

BLACKPOOL.—New church at Marton. F. Freeman, Bolton, and F. H. Gorst and Wm. Cardwell, Blackpool, joint architects; Dryland and Preston, Blackpool, builders.

New hotel in Central Drive for Magee, Marshall & Co., Crown Brewery, Bolton.

Three new schools and extensions to St. John's C.E. Schools.

BLACKROD (Lancs.).—School extension. Rev. G. W. Coleman (vicar).

BOLTON.—New training college for 150 women for the T.C.

(Little Lever.)—Rebuilding the Grapes Inn. Mr. Hamer, Bromley Cross, near Bolton.

Extension to Cross's Mortfield Bleach Works.

(Little Lever).—Queen Anne Hotel to be rebuilt. Manager, Bury Brewery Co., Bury, Lancs.

New school at Smithills. Mr. Wilkinson, Director of Education, Bolton.

BOSTON SPA (Yorks.).—Detached residence. F. Mitchell, architect, 9, Upper Fountaine Street, Albion Street, Leeds.

BOURNEMOUTH.—New public schools at Westbourne (£2,120). J. M. McWilliam & Son, builders, Bournemouth.

BRIDGEND (Pontycymmer).—New schools for Glamorgan C.C. T. M. Franklin, Clerk to the C.C., Westgate Street, Cardiff.

BROADSTAIRS.—Rebuilding 26, High Street, for Mrs. Marsh.

BUDE.—County secondary school for Cornwall C.C. Rogers, Bone & Coles, architects, 7, Cartaret Street, Westminster, London, S.W.

CAMBRIDGE.—New Friendly Societies' Institute.

CASTLETON.—New mill for the Arrow Spinning Co.

CHELMSFORD.—New Baptist church in London Road, and manse (£7,000).

New schools at Springfield for 750 scholars, for the T.C. W. H. Pertwee, architect.

CHESILBOURNE (Dorset).—New schools for the Dorset County Education Committee. County surveyor.

CHESTER.—New elementary school at Mickle Trafford. A. E. Jones, architect, Hunter Street, Chester.

CHORLEY.—Parsonage in Gillibrand Walks for Rev. G. Northridge.

Motor-'bus garage in Friday Street for the Lancashire and Yorkshire Railway Co.

COMBE MARTIN (Devon).—Bungalow residence at Berry Down. Henry Willis, 2, Dany Craig Cottages, Combe Martin.

COVENTRY.—Alterations to All Saints' Church.

Houses in St. George's Road for Yardley & Son.

CREWE.—Proposed cottage hospital.

Proposed temperance institute in Goddard Street.

CRYNANT.—Villa for D. Daniel. J. C. Rees, architect, Neath.

DARLINGTON.—New Wesleyan church at Scorton.

DERBY.—Alteration of premises for Barlow & Taylor, drapers, Market Place. R. Wiston & Son, builders, Derby.

Tram-car sheds for the T.C. John Ward, borough surveyor, Babington Lane, Derby.

DORCHESTER.—Alterations at the Boys' School, Golliton Street. J. Feacey, architect, South Walks, Dorchester.

DOVER.—Houses in Stanhope Road, for W. S. Camden.

DUBLIN.—New winter gardens in connection with Theatre Royal.

DUNFERMLINE.—Second branch library. H. & D. Barclay, architects Glasgow.

DUNOON (N.B.)—Three tenements and shops, and hall in rear (£3,000).

EASTWOOD (Notts.).—Electrical installation at Eastwood Collieries, for Barber, Walker & Co.

ECCLES.—Four shops at Irlams-o'-th'-Height, and two at Urmston, for the Eccles Co-operative Society.

ECCLESTON (Lancs.).—Public elementary school in the Prescot Union, for the Lancashire Education Committee.

EGHAM.—New Liberal Club premises in High Street. J. Leach, hon. secretary.

ELLESMERE PORT (near Chester).—Extensive works for the Hoechst Farbwerke, and Cassella & Co.

EXETER.—Motor garage, shop and house in Blackboy Road. J. A. Lucas, architect, Guildhall Chambers, Exeter.

FENCE HOUSES (Co. Durham).—Eighteen houses for Thos. Hodgson.

FENTON (Staffs.).—Mission hall in Wesley Street.

FLAXTON (Yorks).—Villas in Malton Road for J. H. Johnson.

FILEY.—Concert hall and theatre in Crescent Gardens. R. T. Ellis, honorary secretary.

GLASGOW.—Rebuilding and extension of the Glasgow Sick Children's Hospital (£100,000).

GODALMING.—New voluntary school for the Surrey Education Committee.

GREAT CORNARD (Suffolk).—Elementary school. F. R. Hughes, secretary, West Suffolk Education Committee, Shire Hall, Bury St. Edmunds.

GRIMSBY.—New Church Schools in Legsley Avenue. Gelder & Kitchen, architects, Hull.

HALIFAX.—Pair of semi-detached villas in Lea Avenue. J. H. Shaw, builder.

Shed and engine-house in Back Clarendon Road. J. Smithson, Ltd.

Bungalow in Huddersfield Road. G. H. Greenwood.

HARPENDEN (Herts).—New sanatorium for the Children's Home and Orphanage, Edworth Moors, Bolton (about £6,000).

HARTLEPOOL.—New Primitive Methodist Church in Central Estate District.

HEANOR (Notts.).—Proposed new schools for the County Education Authority (accommodate 250).

HIGH WYCOMBE.—Conversion of premises in High Street into bank for Barclay, Ltd.

HULL.—New seed-crushing mills in Morley Street for Wray, Sanderson & Co.

Tinworks at Stoneferry for J. Wilson.

Additions to works for the National Radiator Co., Chamberland Avenue, and B. B. Mason & Co., Queen's Dock Side.

Houses in Brecon Street for A. Needler.

HOUGHTON-LE-SPRING.—Sub-station at Philadelphia, for the Durham Collieries Electrical Power Co., Ltd.

ILFORD.—Rebuilding "The Hope" and shop adjoining in Ilford Lane, for W. A. Lewis.

Proposed rebuilding of the "Railway" and "Spotted Dog" Hotels, for the London, Tilbury and Southend Railway Co.

KILLARNEY.—Completion of Cathedral (£25,000).

KILMUIR EASTER (Ross-shire).—New Manse. A. Maitland & Sons, architects, Tain.

KING'S NORTON.—New Schools in Raddle Barn Lane, for the King's Norton Education Committee. Mr. Osborne, architect.

KNOTTINGLEY.—New Council Schools for the West Riding of Yorks C.C. Tennant & Collins, architects, Pontefract.

LAINDON HILLS (Essex).—Proposed new Schools for the Essex Education Committee.

LANCASTER.—Houses, Bridge Road, for W. J. Jackson, Sylvester Street, for R. L. Dilworth, and Trafalgar Road, for W. Mashiter.

LEEDSTOWN (Cornwall).—New Wesleyan Sunday School.

Bruce Peebles

& Co. Limited,

ELECTRICAL ENGINEERS AND CONTRACTORS

Edinburgh

Advertising Supplement No. 10. FEBRUARY 1908.

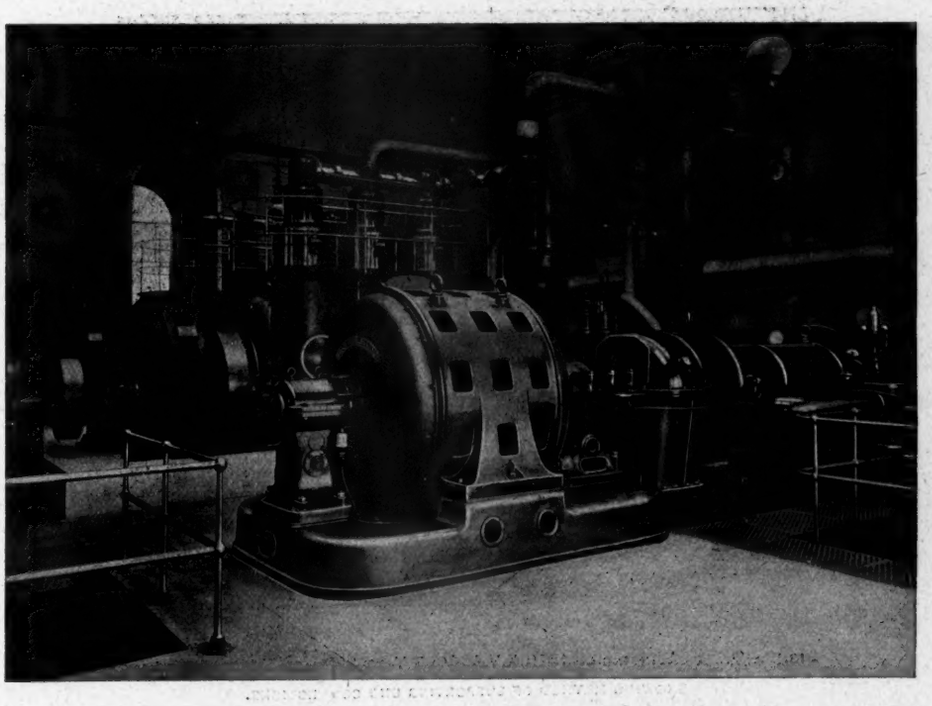


FIG. 1.—1250 K.V.A. PEEBLES TURBO-ALTERNATOR, SUPPLIED TO SCOTTISH CENTRAL ELECTRIC POWER CO. (WILLANS TURBINE).

Turbo-Alternators

THE following list includes a few of the more important Turbo-Generator Contracts recently carried out by BRUCE PEEBLES & Co. LTD.:—

STALEYBRIDGE, HYDE, MOSSLEY, AND DUKINFIELD TRAMWAYS AND ELECTRICITY BOARD.
DURHAM COLLIERIES ELECTRIC POWER COMPANY.
SCOTTISH CENTRAL ELECTRIC POWER COMPANY.
SHANGHAI MUNICIPAL COUNCIL.
OSAKA MUNICIPALITY.
NATAL GOVERNMENT RAILWAYS.
STEPNEY BOROUGH COUNCIL.
POPLAR CORPORATION.
EASTBOURNE CORPORATION.
STAFFORD COAL AND IRON COMPANY.
ASHTON, HARRISON & COMPANY.

Turbo-Alternators

Introductory

PROGRESS in the manufacture of Turbo-Generators has been one of the most outstanding features of electrical development in the past year. During that period, BRUCE PEEBLES & CO. LTD. have booked orders and executed contracts for nearly 20,000 K.W., a good proportion of which represents repeat orders from users who have reason to be satisfied with the performance of their plant.

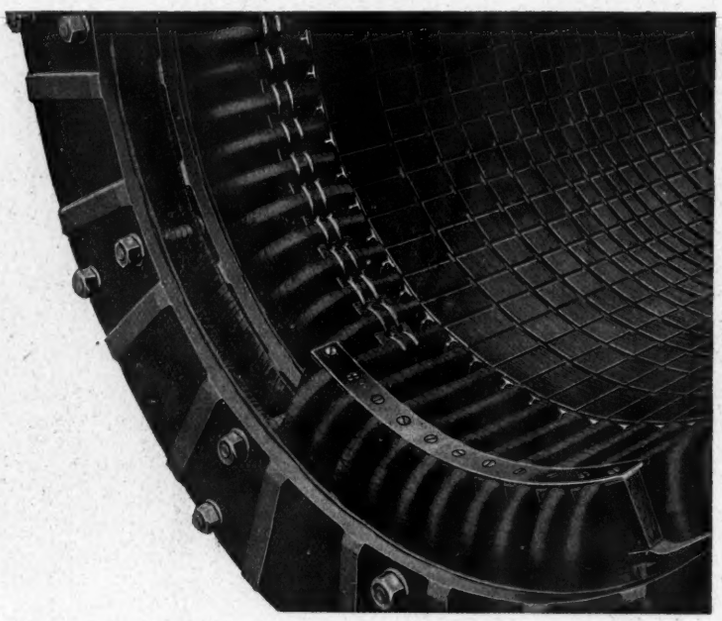


FIG. 2.—STATOR WINDING OF 1500 K.V.A. 6000 VOLT 3-PHASE TURBO-ALTERNATOR, SHOWING METHOD OF SUPPORTING END CONNECTIONS.

Stator

THE general design of our Turbo Stators has not been altered since last advertised, having proved quite satisfactory in the most severe service. The salient points of the design are:—Rigid, but well ventilated carcase, use of finest quality core iron and special insulating processes—hence small core loss and low temperature; partially closed slots, and large number of slots per phase.

Bruce Peebles & Co. Ltd.

Turbo-Alternators

Stator Winding

IN cases of short circuit or heavy overload, the end connections of Stator windings are subject to great stresses, and it is therefore frequently advisable that they should be strongly supported, especially in the case of high-tension machines wound with comparatively light conductor. The method of support illustrated in Fig. 2 has been developed after much trial and experiment, and can be recommended in cases where extreme rigidity is required, since no stress which can exist in the machine will be sufficient to move coils thus secured.

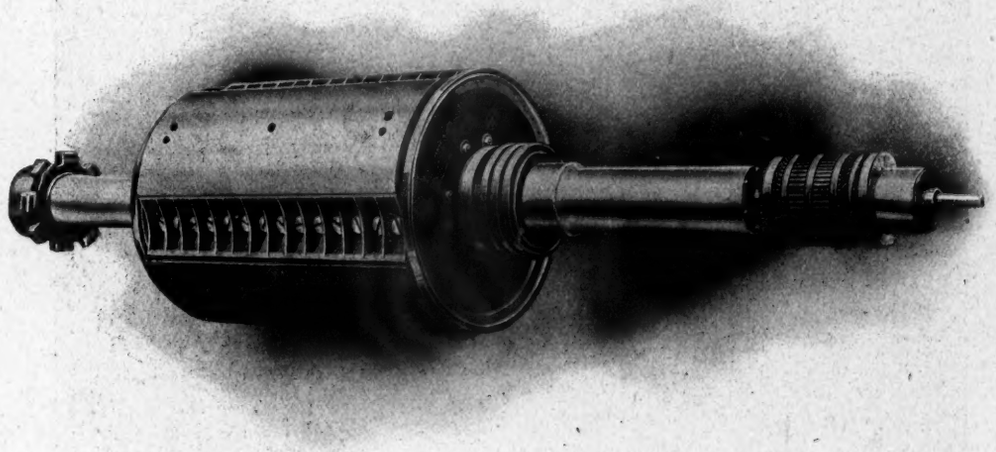


FIG. 3.—STANDARD 4-POLE ROTATING FIELD, 2000 K.W. AT 1200 R.P.M.

Rotating Field

THE Rotor, illustrated in Fig. 3, is our standard construction for 4-pole machines for speeds up to about 2000 R.P.M. It consists of one main casting of special steel, the field coils being wound under heavy pressure direct on to the pole pieces. Particular attention is devoted to securing uniformity of stress throughout, and the gun-metal angle clamps which support the field coils are carried by manganese steel bolts from the main body of casting—thus neither their weight nor the horizontal component of the centrifugal force due to the weight of the field coils falls upon the pole tips. In other words, the structure is strengthened up at the point which would otherwise be its weakest, and absolute rigidity and security

Turbo-Alternators

Rotating Field—*continued*

against distortion or relative movement of parts is assured. Further, the pole tips are not dovetailed on, but are an integral part of the main casting — dovetailing is avoided as weakening the structure.

The above design (Fig. 3) is, of course, not adapted to the requirements of every case, but has been found most satisfactory in service. Special designs are available to meet special cases.

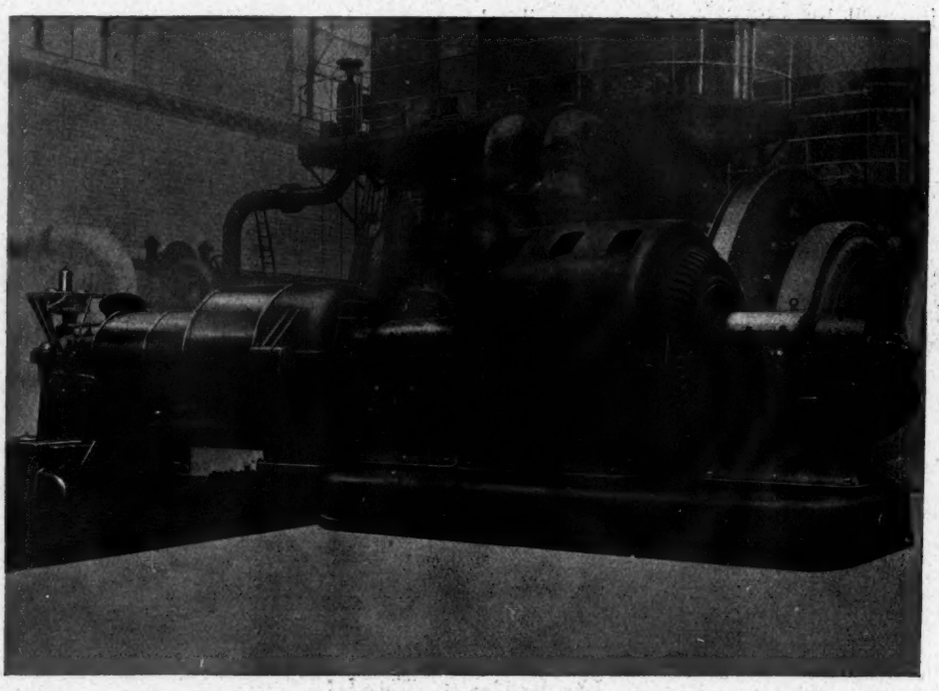


FIG. 4.—2350 K.V.A. UNIT, SUPPLIED TO STALEYBRIDGE, HYDE, MOSSLEY & DUKINFIELD JOINT BOARD.

Bruce Peebles

& Co. Limited,

ELECTRICAL ENGINEERS AND CONTRACTORS.

LONDON: 1 London Wall Buildings, E.C.

MANCHESTER: 64 Cross Street.

EDINBURGH: East Pilton Works.

SOUTH AFRICA: Reunert & Lenz, Consolidated Buildings, Johannesburg.

CHILE AND BOLIVIA: Martin Bros., Calle Blanco 223, Valparaiso.

SOUTH BRAZIL: M'Lauchlan, Machado & Co., Rue de S. Pedro N. 37, Rio de Janeiro.

CHINA: Jardine, Matheson & Co. Ltd., Shanghai and Hong-Kong.

AUSTRALIA: F. A. M'Carty & Co., 31 Queen Street, Melbourne.

JAPAN: L. J. Healing & Co., 22 Yamashita-Cho, Yokohama; and 88 Yedo Machi, Kobe.

Printed by WILLIAM CATE LTD., Hogarth House, Bouverie Street, and Published by the Proprietors, H. ALABASTER, GATEHOUSE & CO., at 4 Ludgate Hill, London.

LEOMINSTER.—New Secondary School in South Street. County Surveyor, Shire Hall, Hereford.

LINLITHGOW.—Improvements at the Public School for the Parish School Board (£350).

LONDON (Hornsey, N.).—Repairs to the Manor House and erection of a new Hall in High Street, for the Crouch End Association.

(Islington, N.).—Fitting up Agricultural Hall (estimated at £7,000), for Exhibition in June, for Church Missionary Society, 14, Salisbury Square, E.C.

(W.).—Buildings in St. Martin's Lane. Leslie & Co., St. James' House, Kensington Square, W., builders.

(W.).—Alterations to 86, Oxford Street, prior to occupation by Thos. Cook & Son, tourist agents, Ludgate Circus, E.C.

(Leytonstone).—Alterations to 578 and 580, High Road. A. W. Cleaver, architect, 54-55, London Wall, E.C.

(W.)—Theatre in Haymarket for J. N. Lyons. Runty & Ford, architects, 10-12, Walbrook, E.C.

(Leyton).—Iron mission hall, Harrow Road. F. Smith & Co., Stratford.

(Walthamstow).—Motor garage in Courtenay Place. F. B. E Amos, care of Town Clerk, Walthamstow U.D.C.

(Tooting Junction).—Business premises in London Road for J. W. Hallett.

(Finsbury).—Three warehouses in Chiswell Street (£11,500). Chas. E. Jackson, Broad Street House, New Broad Street, E.C. architect.

(Paddington Green, W.)—Stores and stabling (£2,120). W. F. Meakin & Son, 6, Martin's Lane, E.C., architects. Thompson and Beveridge, 151, Harrow Road, W., builders.

(Kempton Park).—Coal bays, workshops, &c. (£9,995). Wm. B. Bryan, chief engineer Metropolitan Water Board, Savoy Court, Strand, W.C. Kirk & Randall, Woolwich, builders.

(Wimbledon, S.W.)—Houses at Mount Ararat Estate. T. Eaton Wandsworth Common, builder.

(Tooting).—Shops and flats in High Street. Geo. Thompson, Moffatt Road. Tooting, builder.

(Bermondsey, S.E.)—Adaptation of premises in Vine Street for Girls' Club. Rev. H. Williams, St. John's Clergy House, Fair Street, Horselydown, S.E.

(Bermondsey, S.E.)—Installation of electrical energy by Gardiner and Tidy, 79, Bermondsey Wall, S.E., wharfingers.

(Hampstead, N.W.)—Motor garage in Church Walk. J. D. Hunter, 305, Finchley Road, N.W.

(Hendon, N.W.)—School at The Hyde. Architect, Hendon Education Committee.

(Highgate, N.W.)—Additions to Congregational Hall (£2,000).

Building completion (£6,000) for Homes of St. Barnabas. Rev. S. J. Clements, secretary, Church House, Westminster, S.W.

(Harlesden, N.W.).—Alterations to "Royal Oak." G. A. Sexton, architect, 42, High Road, Kilburn, N.W.

(Harrow Road, W.).—Alterations to Tavistock Dairy, St. Mary's Terrace. J. Farrer, architect, 2, Coleman Street, E.C.

(Brondesbury, N.W.).—Three houses, Shoot-up-Hill. Hudson and Hunt, architects, 24, York Place, W.

(Fitzroy Square, W.).—Extensions to the Hostel of St. Luke. Ven. Archdeacon Utterton, chairman, The Close, Winchester.

(Earl's Court, S.W.).—Alterations, &c., in connection with the Hungarian Exhibition. A. O. Collard, architect, 8, Buckingham Street, Strand, W.C.

(Westminster, S.W.).—Buildings in Palmer Street. Barlow and Roberts, 15, Red Cross Street, S.E., builders.

(Willesden Junction, N.W.).—Shop, &c., Station Road. H. Shaw, architect, 60, Nicholl Road, Willesden,

(Wimbledon, S.W.).—Seven dwelling houses. H. Branch, architect, 25, Cheapside, E.C.

(Tottenham, N.).—Forty-seven houses and one shop. G. W. Rowley, 278, Philip Lane, Tottenham, N., builder.

(Willesden, N.W.).—Additions to laundry for the Coronet Laundry, Ltd., Alric Avenue, N.W.

(Bermondsey, S.E.).—Extension of bakery. W. Lawrence & Son, Mosille Works, Tottenham, builders.

LUTON.—Wesleyan Chapels in Dallow and Dunstable Roads. A. E. Lambert, architect, 22, Park Row, Nottingham.

LYNTON (Devon).—Detached residence and five cottages for C. R. Fursdon. W. C. Oliver & Son, architects, Bridge End, Barnstaple.

MAIDSTONE.—New maltings for Style & Winch, Ltd., brewers (£11,776). L. E. Wallis & Son, builders, Broadmead Works, Hart Street, Maidstone.

MANCHESTER.—New United Methodist Church in Leicester Road. George and Tonge, architects, Southport.

MIDDLESBROUGH.—New business premises, for Stewarts, Ltd., clothiers. W. G. Roberts, architect, 61, Albert Road, Middlesbrough.

Carnegie Free Library under consideration (£15,000).

MIRFIELD (Yorks.).—Houses, Lower Hepton, for F. Barraclough.

MORLEY.—Alterations and additions to Grove Mills, for D. Bradley, Ltd. T. A. Buttery, architect, Queen Street, Morley; and 1, Basinghall Square, Leeds.

MOSSLEY.—Houses for the Mossley Co-operative Society.

NANTWICH.—New school to replace one destroyed by fire. County Education Architect, Chester.

Proposed extensions to local workhouse.

NETHERTON.—Building scheme in connection with the Netherton Wesleyan Methodist Church.

NORTH DEVON (Parracombe).—Repairs to Parish Church (struck by lightning).

OLDBURY.—The Museum and Palace Theatre of Varieties to be rebuilt.

Proposed alteration to the Gate Inn, Road End.

OLDHAM.—New theatre to seat 2,638 persons for the Variety Enterprise, Ltd., London.

OXFORD.—Proposed District Police Station.

PENTRE (Rhondda).—Alterations and additions to business premises, 196-7, Ystrad Road, for Hodges & Sons, outfitters, Aberdare. T. E. Richards, architect, Pontypridd.

PERTH.—Vestry and Session House for St. Stephen's Parish Church, Craigie.

PETERHEAD.—Proposed new higher-grade school buildings in connection with the Academy. A. Clyne, architect, 123½, Union Street, Aberdeen.

PRESTON.—New theatre. E. Bush, architect, Preston.

PRUDHOE (Northumberland).—Shops and houses in Front Street. J. Harkness, East View, Prudhoe.

PURLEY (Surrey).—New bank at Purley Corner for Union of London and Smith's Bank Ltd.

RETFORD.—New offices and sale room in The Square for H. Spencer & Sons, auctioneers. Mr. Southall, Chapelgate, Retford.

RUGBY.—Houses in Bath Street for G. Head.

ST. ALBANS.—New schools on Hall Place Estate (£3,000). A. L. Champneys, architect, 99, St. Peter's Street, St. Albans.

ST. ANNES-ON-THE-SEA.—Proposed cottage hospital.

SELKIRK.—Proposed social institute next to Municipal Offices.

SETTLE (Yorks.).—Alterations at the Golden Lion Hotel.

SHIPLEY (Yorks.).—Additions to Westfield Works, Wrose Hill, for M. Kellett and Sons, Ltd.

SHREWSBURY.—Pavilion in Victoria Avenue. Dickens, Lewis & Haynes architects, Talbot Chambers, Shrewsbury.

SOUTHEND-ON-SEA.—New school at Chalkwell Hall, Westcliff. W. J. Wood, architect, 26, Alexandra Street, Southend-on-Sea.

SOWERBY BRIDGE (Yorks.).—New secondary school (£14,000). Longbottom and Culpan, architects, Somerset Chambers, George Street, Halifax.

STONE (Staffs.).—New laboratory, class and lecture rooms, &c., at Alleyne's Grammar School. W. E. Rogers, architect, Rugeley.

SUNDERLAND.—New Church of St. Mary Magdalene in Willow Pond Terrace.

SUTTON COLDFIELD.—Carnegie free library (£3,500) under consideration by the T.C.

TEDDINGTON.—New premises for London and County Bank in High Street. W. Nash, Crown Works, Deptford, builder.

WESHAM (Lancs.).—Proposed new vicarage.

WOLVERHAMPTON.—Extensions at the General Post Office.

WORTHING.—Extensions to the hospital.

YORK.—Houses (28) in Curzon Terrace for C. Martin.

YSTRAD RHONDDA.—Villa residence for A. Cule at Pyntyla. Evans, Williams and Evans, architects, Pontypridd.

CONTRACTS OPEN and CLOSED.

OPEN.

Aston Manor.—February 17th. One 2,000-KW. turbo-alternator, condenser, pumps, &c., for the Electricity Department. See "Official Notices" to-day.

Battersea.—February 18th. Materials for the electricity department for one year. See "Official Notices" January 31st.

Belfast.—February 22nd. Low-tension insulated V.B. cable for one year for the tramways and electricity department. See "Official Notices" January 31st.

Belgium.—February 29th. Thirty electrical cranes at the docks for the municipal authorities of Ghent.

Bermondsey.—February 17th. Stores, &c., for the Council's electricity and destructor works. See "Official Notices" January 24th.

Blackburn.—February 15th. Stores for one year for the electricity and tramways department. See "Official Notices" January 31st.

Bristol.—February 17th. Electric lighting installations

Burnley.—February 12th. Booster for the workhouse. See "Official Notices" January 31st.

Castlerea.—February 22nd. Suction gas plant, gas engines, dynamos, battery, switchgear, lines, lamps, &c., for the electric lighting of the town of Ballaghaderreen for the Castlerea R.D.C. See "Official Notices" January 31st.

Edinburgh.—February 10th. Extension switchboard panel for M'Donald Road electricity works. See "Official Notices" January 31st.

Germany.—February 21st. The Prussian State Railway authorities in Berlin are inviting tenders until the 21st inst. for the supply of 303 tons of galvanised iron wire, 13 tons of insulated wire, 3 tons of copper wire, 87,060 insulators, and 18,000 metres of telegraph wire.

Glasgow.—April 13th. Two movable bridges over the Forth and Clyde Canal for the tramways department. Particulars from Mr. J. Dalrymple, general manager.

Gravesend.—February 17th. Coal and stores for the electricity department. See "Official Notices" January 31st.

Halifax.—February 12th. Stores for the tramways and electricity departments for the Corporation. See "Official Notices" to-day.

Hammersmith.—February 19th. Stores for the electricity department. See "Official Notices" January 31st.

Hampstead.—February 13th. Oils for electric lighting station; and removal of ashes. Particulars from Borough Surveyor Town Hall.

Handsworth.—March 4th. 315-KW. engine and dynamo, feed pump, economiser and pipework, and switchgear, for the U.D.C. electric light and power department. See "Official Notices" to-day.

Hornsey.—February 17th. Electric wiring, &c., of certain buildings for the Council. See "Official Notices" January 24th.

Hull.—February 10th. Electric light installation, fittings and fans for Selby Street West School, now erecting for the Corporation Education Committee. J. H. Hirst, city architect.

Ilford.—February 25th. One 1,000-KW. steam dynamo, water-tube boiler and accessories for the U.D.C. See "Official Notices" to-day.

Islington.—February 18th. Electrical and engineers' stores for the B.C. See "Official Notices" January 24th.

Islington.—February 25th. 1,500-KW. steam turbine, alternator, exciter, condensing plant, switchgear, water-tube boilers conveyer, bunkers, piping, &c., for the B.C. electricity department. See "Official Notices" to-day.

Leeds.—February 10th. Steam and exhaust piping, &c., for the Corporation E.L. department. See "Official Notices" January 24th.

Leeds.—February 21st. Sundry materials, also coal, sand, &c., for the City Tramways Committee. Also tenders for the purchase of scrap metal. J. B. Hamilton, tramway manager.

Manchester.—February 17th. A 2-ton steam travelling crane for the Tramways Committee.

Manchester.—February 25th. Four water-tube boilers and accessories for the electricity department. See "Official Notices" to-day.

Rathmines and Rathgar.—February 13th. Coal and other supplies for the U.D.C. electricity works. See "Official Notices" January 24th.

Rawtenstall.—February 7th. Balancing set, transformers and transforming plant, boilers, feed pumps, condensers, piping, &c., for the Corporation electricity supply department. See "Official Notices" January 24th.

Rawtenstall.—February 10th. Erection of the generating station buildings and chimney stack at Hareholme, near Waterfoot. Plans, &c., from Lacey, Sillar & Leigh, 78, King Street, Manchester (deposit three guineas).

Rawtenstall.—February 21st. Travelling cranes, accumulators, reversible boosters, &c., for the electricity supply department. See "Official Notices" to-day.

Salford.—February 17th. Addition electric light installations at the central car depôt, Pendleton, for the Tramways Committee. Specifications, &c., from General Manager (one guinea).

Sheffield.—February 10th. Stores for the Tramways Committee. See "Official Notices" January 24th.

Swansea.—February 21st. Motors and starting switches for the 12 months for the Corporation. See "Official Notices" January 31st.

The Tyrol.—The municipal authorities of the little town of Ried are about to invite tenders for the establishment of a central electric lighting station.

Wallasey.—February 12th. The manager of the U.D.C. Tramways, Egremont, is inviting tenders for the supply of stores, consisting of forged-steel axles, chilled-iron car wheels, ditto brake blocks, armature bearings, steel gears, &c.

Wimbledon.—February 18th. Flame arc lamp carbons for one year for the electricity department. See "Official Notices" January 17th.

Wimbledon.—February 18th. One 1,000-KW. turbo-alternator, with condensing plant; two water-tube boilers, economisers, pipe-work and feed pump; switchboard and switchboard gallery, for the Corporation electricity department. See "Official Notices" January 10th.

Wimbledon.—February 18th. Cables and conduit for the electricity department for one year. See "Official Notices" January 31st.

Wimbledon.—February 29th. Stores for the electricity department. See "Official Notices" to-day.

CLOSED.

Cardiff.—The Corporation Electrical and Tramways Committee has accepted the tender of the British Insulated and Helsby Cables, Ltd., for high-tension cables, at £593, and that of the British Westinghouse Co., Ltd., for a 700-KW. motor-generator, at £1,345.

Clacton-on-Sea.—The U.D.C. has accepted the tender of Messrs. Chamberlain & Hookham for the supply of meters.

Croydon.—The B.C. resolved on Monday to enter into a new contract with Messrs. Callender's Cable and Construction Co., Ltd., for the supply of cables for the ensuing two years "on the basis of copper not exceeding £66 per ton."

Derby.—The T.C. has accepted the tender of the Otis Elevator Co., Ltd., for an elevator at the new power station, at £150.

Hanley.—The contract for the lighting (arcs and Osram lamps) of the new premises of Messrs. Lipton, Ltd., has been given to Mr. Chas. Pullan, of Bradford.

Herts.—The C.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for the construction of the Cheshunt Light Railway, at £4,176.

Hull.—The Telephone Committee of the T.C. has accepted the tender of the British Insulated & Helsby Cables, Ltd., for cables, at £254, and that of Messrs. James MacMillan & Co. for instruments, at £368 15s.

The Corporation Tramways Committee on Friday accepted the tender of Messrs. Siemens Bros. for the supply of a generator, at £793, and a spare armature for the power station, at £362.

Ilford.—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Works, Ltd., for feeder cable, at £1,130. The lowest tender, from a foreign firm, was passed over.

Leyton.—The U.D.C. considered tenders for machine tools for the electricity undertaking. The electrical engineer reported that the three lowest tenders for a lathe were those of Messrs. Lowden Bros., Ltd., £104; Messrs. Blackwell & Co., Ltd., £105 15s.; and Messrs. Carter & Wright, £107. The two first-named are merchants, and the last is a manufacturer. The engineer stated that he did not recommend the acceptance of a tender of a merchant when the price of a manufacturer is but a little more, and the inquiries which he had made of firms and public bodies using machine tools made by Messrs. Carter & Wright gave good reports. With regard to the tenders for a screwing machine, the first four names on the list are merchants, the prices being from £40 6s. 6d. to £45. There were two other prices of £45, viz., Messrs. Selig, Sonnenthal & Co., and Messrs. Tangyes, Ltd., both of whom are manufacturers. Tangyes, Ltd., would not agree to penalties for non-delivery to date or to the wages clause, but stated that they paid standard rates of wages in the district. The engineer thought that Messrs. Tangyes' views could be met. The Electricity Committee recommended the acceptance of the tender of Messrs. Carter & Wright for the supply of a lathe, and of that of Messrs. Tangyes, Ltd., for the supply of a screwing machine, and this was agreed to.

London.—SHOREDITCH.—The B.C. has received the following tenders for the supply of (1) ⅜ mile 19/14; (2) 1¼ miles 7/14; (3) 1¼ miles 7/16 lead-covered paper-insulated cable:—

		(1)	(2)	(3)	Total.
W. T. Henley & Co.	(accepted)	£120	£99	£79	£298
Western Electric Co.		121	101	80	303
W. T. Glover & Co.		125	101	80	303
British Insulated & Helsby Cables, Ltd.		121	100	82	304
Callender's Cable Co.		122	102	81	306
Siemens Bros. & Co.		123	102	82	307
Lahmeyer Electrical Co.		130	107	85	322
Geipel & Lange, Ltd.		128	113	102	338

L.C.C.—The Highways Committee of the L.C.C. has received the undernoted tenders for the roadwork and platelaying in connection with the reconstruction of tramways in Caledonian Road and Seven Sisters Road:—

Dick, Kerr & Co.	(recommended)	£53,516
R. W. Blackwell & Co.		55,018
W. Manders		56,634
J. G. White & Co.		58,249
John Mowlem & Co.		59,007
Edmund Nuttall & Co.		59,917
W. Underwood & Bro.		61,240
William Griffiths & Co.		62,041
William Muirhead & Co.		62,110
National Electric Construction Co.		64,993
George Law		68,489

The amount of the engineer's estimate was £58,986. It is proposed to place upon the contractors the condition that preference in employment on casual or unskilled labour required for the work should be given to men *bonâ fide* resident in the county of London, and they have intimated their willingness to adopt this course.

Manchester.—The following tenders have been accepted by the Corporation Electricity Committee:—

Ferranti, Ltd.—High and low-tension switchgear.
Newton, Chambers & Co.—Low-pressure circulating water pipework at Dickinson Street and Bloom Street stations.
Electrical Co.—Armature wire.
Callender's Cable & Construction Co.—Extra-high-tension cable.

Stoke-on-Trent.—The T.C. has accepted the tender of the Corporation Electricity Committee for providing and fixing 42 32-c.p. Osram lamps in the market, and an electric ventilating fan in the committee room.

FORTHCOMING EVENTS.

To-day's Events (Friday, February 7th).—At 8 p.m. Royal United Service Institution, Whitehall. Junior Institution of Engineers. "Aerial Navigation," by Mr. H. Chatley.

At 8 p.m. Institution of Civil Engineers. Mr. P. T. Steinthal on "Electric Hardening and Annealing Furnaces."

Saturday, February 8th.—At 6.30 for 7 p.m. Junior Institution of Engineers. Hotel Cecil. Anniversary dinner.

At 3 p.m. Liverpool and District Electrical Association. Visit to turbine steamer *Virginian* (Allan Line) in No. 2 Canada Dock.

Monday, February 10th.—At 8 p.m. Institution of Mechanical Engineers. Graduates' lecture, by Prof. W. E. Dalby, on "Balancing of Reciprocating Engines."

Tuesday, February 11th.—At 8 p.m. Liverpool and District Electrical Association. Conclusion of discussion on paper by Mr. J. Greenhalgh on "Fuel Economy in Steam Generating Plants," and discussion *re* visit to turbine steamer *Virginian*.

At 7 p.m. At the Hotel Cecil. Physical Society's dinner.

Wednesday, February 12th.—At 7.30 p.m. Institution of Electrical Engineers. Students' meeting. "Train Lighting," by Mr. G. H. Nelson.

At 8 p.m. Royal Society of Arts. Paper on "The Application of Science to Foundry Work," by Mr. R. Buchanan.

At 7.30 p.m. Institution of Electrical Engineers (Birmingham Section). Papers:—"Experimental Determination of the Losses in Pole Shoes, due to Armature Teeth," by Mr. T. F. Wall, M.Sc., B. Eng., Student, and Mr. S. P. Smith, B.Sc.; and "The Reluctance of the Air-Gap in Dynamo Machines," by Mr. T. F. Wall.

At 8 p.m. At the Architectural Association. Junior Institution of Engineers. Paper on "Suggestions as to How the Architect and the Engineer may Combine," by Mr. P. J. Waldram.

Friday, February 14th.—At 8 p.m. At the Royal College of Science. Physical Society. Presidential address by Prof. J. Perry.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Monday, February 10th.—"A" Company. Infantry drill, 6 p.m.; technical drill, 7 p.m.
Tuesday, February 11th.—"B" Company. Infantry drill (recruits), 6 p.m.; technical drill, 7 p.m.
Wednesday, February 12th.—"A" Badge examination, at 6 p.m.
Thursday, February 13th.—"C" Company. Infantry drill (recruits), 6 p.m.; technical drill, 7 p.m.
Friday, February 14th.—"D" Company. Infantry drill, 6 p.m.; technical drill, 7 p.m.

J. H. S. PHILLIPS, Capt.,
Acting Adjutant.

NOTES.

International Electro-technical Commission.—The constitution of the British Electro-technical Committee, re-appointed by the Institution of Electrical Engineers for 1908, is as follows:—

Sir John Gavey, C.B. (President).

Col. R. E. Crompton, C.B.
Mr. W. Duddell, F.R.S.
Mr. Kenelm Edgcumbe.
Dr. Gisbert Kapp.
Dr. R. T. Glazebrook, F.R.S.
Mr. R. Kaye Gray.
Mr. Robert Hammond.
Col. H. C. L. Holden, F.R.S.
Mr. T. Mather, F.R.S.
Mr. H. W. Miller.
Prof. J. Perry, F.R.S.
Sir W. H. Preece, K.C.B., F.R.S.
The Rt. Hon. Lord Rayleigh, O.M., F.R.S.
Mr. Alex. Siemens.
Mr. C. P. Sparks.
Mr. J. Swinburne, F.R.S.
Prof. S. P. Thompson, F.R.S.
Mr. A. P. Trotter.
Mr. E. B. Vignoles.
Mr. C. H. Wordingham.

Mr. G. C. Lloyd (Hon. Secretary).
Mr. C. le Maistre (Secretary).

The Committee is about to take up the question of "Symbols," and a Sub-committee has been appointed, and is in process of formation, to deal with the matter, with a view to international agreement.

Canadian Trade.—Reuter's agent at Montreal says that Mr. Salter, European traffic manager of the Grand Trunk Railroad, has just urged the necessity of a Canadian agent being attached to the British Consulates at the leading commercial centres in Europe. He holds that there is a regrettable indifference to Canadian trade interests on the part of British Consuls.

Appointments Vacant.—Working assistant engineer for the Hants County Asylum (£104); assistant distribution engineer for Woolwich electricity department (£90).

A Pontypool Prosecution.—At Pontypool Police Court last week, Mr. J. W. Wyatt, electrical engineer, of Crane Street, Pontypool, was summoned for laying or causing to be laid an electric wire to communicate with an electric wire, the property of the Pontypool Electric Light Co., Ltd., without their consent, at Pontypool, on December 23rd, and for improperly using or burning electricity supplied to him by the company on the same date. Defendant pleaded not guilty.

W. J. Maybury, engineer to the Pontypool Electric Light Co., Ltd., said that on December 23rd, in company with his wiremen, he visited the defendant's premises and examined the meter and the wires. He found that a wire had been connected with the company's main fuse outside the meter, thus diverting the current that should have gone through the meter. The wire had been connected with the terminal of the company's main, and the fuse-boxes had been left uncovered. Witness asked for an explanation, and later defendant suggested that he should give him a Christmas box to settle the matter. Witness refused to accept the offer, and pointed out that it was remarkable that the consumption of current in each of the three respective months preceding December was as low as five units per month. Replying to Mr. Saunders, solicitor for the defendant, witness said the wire had been connected in a place where it could easily be seen. It would have been quite easy for the defendant to have connected with the mains in the basement, and it would then have been much more difficult to discover the connection.

Mr. Saunders said the company practically alleged that the defendant had committed a fraud. It was absurd to think that a man in Mr. Wyatt's position would do such a thing. The whole of the affair was done by Mr. Wyatt's brother and two apprentices, who took the course they did as it was easier and quicker than any other.

The defendant, giving evidence on his own behalf, stated that on December 23rd he received three complaints that the light in the show case in front of the dentist's premises was not working properly. He instructed his brother and an apprentice to repair the defect. When they were in the middle of the work, witness received a call to the Pontypool Works, and he at once ordered his brother and an apprentice to proceed there. Soon after they went, Mr. Maybury came in. Witness's brother explained what had happened. Witness denied that he had offered to give Maybury a Christmas box to settle the matter. All that he did was to complain that it was hard on the gentleman who rented the premises adjoining his to have the light cut off, and he offered to pay for the light to be placed on for them. Witness admitted that the current had been used on the wrong side of the meter, but that was not an unusual custom in testing a show-case such as the one in question. He also admitted that his brother had that day tested an arc lamp, by means of an ammeter, where the connection complained of had been made.

Harold Wyatt gave corroborative evidence, and said he did not think, when he made the connection of the wire, that he was "cutting out" the company's meter.

The Bench decided to dismiss the first summons. On the second, defendant was find 20s. and costs (10s.). At the same time, said the bench, defendant ought to have notified the company if any thing was wrong with his plant. That was the crux of the whole matter.

I.M.E.A. and the New Regulations.—At a general meeting held on Tuesday, February 4th, at the Hotel Great Central, Marylebone, consideration was given to the draft regulations for the generation, transformation, distribution and use of electrical energy under the Factory and Workshop Act, 1904. The following resolutions were passed:—

1. That the Association of Municipal Corporations be informed that the I.M.E.A. is willing to take joint action with them in regard to the employment of "counsel," and tender expert evidence, it being understood that the objections raised by the I.M.E.A. form part of the instructions to counsel.
2. In the event of joint action of the Association of Municipal Corporations and I.M.E.A. not being arranged, the I.M.E.A. to proceed independently.
3. That the president, immediate past-president, senior vice-president, hon. solicitor, and hon. secretary, should form a sub-committee with power to act and to retain counsel if desirable.
4. This general meeting is of opinion that the municipalities which this Association represents should contribute towards the necessary expenses *pro rata* with their gross annual revenue.

The question of Local Government Board loans and the Supply of Electricity Bill was also discussed, and steps are being taken to approach the Local Government Board and the Board of Trade in regard to these matters.

Electric Shock Fatality.—We understand that on Tuesday a workman at the electric power station on the Liverpool and Southport Railway was killed by falling on the live rail while crossing the line near Birkdale. The body, which was badly burnt, was run over by a train.

Business in India.—A correspondent sends us the following copy of an inquiry from a native firm, which is, as he says, decidedly original:—

Dear Sirs,

Will you please explain the undermentioned questions and send us a complete catalogue of Lathes and Dynomos.

Dynomo.

Amps. ... 60
Volts ... 105
Revs. ... 1,250

(1) Its price.
(2) How many horse-power does it possess.
(3) Quantity of Battries it will require to give satisfactry work.

Yours faithfully.

There is, however, a substratum of reason at the bottom of it, and probably the writer knew better what he wanted than how to ask for it.

Institution and Lecture Notes.—THE IRON AND STEEL INSTITUTE.—The annual general meeting will be held at the Institution of Civil Engineers, Great George Street, London, S.W., on Thursday and Friday, May 14th and 15th. The annual dinner will be held at the Hotel Cecil on May 14th. The autumn meeting will be held in Middlesbrough on September 29th and following days. The Council will shortly proceed to award Carnegie Research Scholarships, and candidates must apply before February 29th.

ASSOCIATION OF ENGINEERS-IN-CHARGE.—The Association has felt the need of a lending library to enable its members to improve their knowledge of engineering, and is handicapped by the fact that out of 10,000 volumes in the St. Bride's Institute Library, to which the members have access, only 75 relate to engineering. The Institute is willing to house the books, and the authors of technical works will do the Association a great service if they will present complimentary copies to the Educational Committee; the Association is well worthy of such favours, which will be thankfully received and faithfully applied.

THE ROYAL SOCIETY OF ARTS.—His Majesty the King, who is patron of the Society of Arts, has granted permission to the Society to prefix to its title the term "Royal," and the Society will consequently in future be known as the "Royal Society of Arts."

BIRMINGHAM ASSOCIATION OF STUDENTS OF THE INST. C.E.—The annual dinner was held on Thursday last week at the Grand Hotel, Birmingham. Prof. S. M. Dixon (chief of the Civil Engineering Department of the Birmingham University), presided.

SOCIETY OF ENGINEERS.—The first ordinary meeting for the present year was held on February 3rd, when Mr. Maurice Wilson, the president for 1906, presented the premiums awarded for papers read during the year. Mr. J. W. Wilson, the new president, then proceeded to deliver his inaugural address. He alluded to the heavy losses which the society had sustained during 1907 by the deaths of their honorary members, Lord Kelvin and Sir Benjamin Baker; of the vice-president, Mr. W. H. Holttum; and of their secretary, Mr. Perry F. Nursey, who had been a member of the society for nearly 50 years, and had filled the positions of president and honorary treasurer, as well as secretary. The vacancies in the list of honorary members had been filled by the election of Sir Edward Raban, C.B., and Sir William Matthews, K.C.B., president of the Institution of Civil Engineers; and Mr. A. S. E. Ackermann, B.Sc. (Eng.), A.M.I.C.E., had been appointed secretary. The President touched upon the problem of the training of an engineer, showing that, although they were careful to apply "common sense to the raw material" in engineering manufactures, they often failed to do so in the production of the engineer himself. He emphasised the comparative failure of our leading schools in this respect, and urged that they should devote their great opportunities to a more practical end so that the grievous waste of time, now so common when a youth embarked upon his profession, might be as far as possible removed.

THE INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS.—A paper on "The Construction of Aerial Lines," read by Mr. J. H. M. Wakefield on December 9th, 1907, before this Institution in London (England) has just reached us. It deals, *inter alia*, with the factor of safety for wood poles and stays, and the question of lightning protection at the junction of bare and covered wire. The author suggests that a factor of safety of 5 for wood poles is ample, and takes as his standard a total effective wind pressure of 791 lb. on a pole which has a breaking stress of 4,032 lb. A factor of safety of 2 is suggested for stays, and a table is given showing details of stays for lines carrying from 8 to 60 wires of various gauges. With regard to lightning protectors, a rule is suggested that if a cable, whether aerial or underground, is worth, say, not less than four times the cost of lightning protectors, the latter should be fitted at the junction of the underground or aerial cable with the bare wire. For example, if a length of cable valued at £35 was joined to bare wires, lightning protectors should be fitted if the cost did not exceed £8. Other matters dealt with in the paper are working loads for iron poles, concrete poles, aerial cables, and overhead structures on Crown post offices. The paper, which is illustrated with 24 plates, can be obtained at a nominal figure from the secretary, Institution of P.O. Electrical Engineers, G.P.O. (W.), London, E.C., England.

PHYSICAL SOCIETY OF LONDON.—At the meeting on January 24th, Prof. J. Perry, F.R.S., President, in the chair, a paper by Mr. W. Rosenhain on "Observations on Recalescence Curves" was read by Dr. R. T. Glazebrook.

A paper was read before the Estate Agents' Institute last week by Mr. S. J. Chesterton on "Modern Locomotion and its Effect upon Property." He dealt respectively with tube railways; electric tramways, motor-omnibuses and motor traction.

SOUTH-WESTERN POLYTECHNIC, CHELSEA.—Lord Alverstone, G.C.M.G., Lord Chief Justice of England, will present prizes and certificates to students of evening classes and day college on March 13th, at 8 p.m.

West Ham Electrical Staff Dinner.—On Thursday last week the staff of the West Ham Corporation Electricity Department held their second annual dinner at the Restaurant Frascati, and there was a very large attendance. The borough electrical engineer, Mr. A. Hugh Seabrook, occupied the chair, supported by the deputy-mayor and the chairman of the Electricity Committee, and numerous representatives and officials of municipal authorities, consulting engineers, and consumers were present.

After the loyal toasts had been duly honoured, Mr. W. Fletcher, engineer to the Co-operative Wholesale Society, Ltd., proposed "The Mayor and Corporation." As a newcomer to the district, he had been pleased to find that there was no connection between the Corporation and the Guardians. He was a consumer of 5½ million units per annum, having installed electric motive power throughout a large flour mill belonging to the Society, in consequence of his satisfactory experience in connection with the Dunston mill [described in our pages on November 16th, 1906]. He found it hard to drive a bargain with the Newcastle Co., but it was no less difficult to make terms with West Ham Corporation.

The Deputy-Mayor responded, and remarked that in the mill in West Ham, mentioned by Mr. Fletcher, steam plant had been displaced in favour of electricity. There was an immediate demand for power in Silvertown directly it was available. The rates were the main consideration there, and the cheap power system was on its trial.

Alderman Littler proposed "The Electricity Department," of which he had been chairman for over two years. He said that a wonderful development had taken place during the last two years, due to the energy and determination of Mr. Seabrook and his staff. They had supplied cheap and reliable power to the manufacturers of West Ham, who were the life-blood of the borough. Not only were they endeavouring to attract British manufacturers from all parts to West Ham, but in view of the stipulations of the new Patents Act as to manufacture in this country, they were trying to induce foreign firms to set up works in the district. They had become wholesale dealers in electrical fittings (a voice—"Shame!" and laughter) and supplied the local contractors at prices they could not get in the city. The borough was an ideal place for manufacturers, being outside the L.C.C. area, and the rates were going down; £381,000 had been invested in the undertaking, 6,000 H.P. of motors had been supplied, the annual output had risen from six million units a year ago to (estimated) 11½ millions by the end of March next, the sales department had a turnover of £7,000 in 12 months and the stores department over £50,000.

In his reply, Mr. Seabrook complimented the staff on their enthusiasm and self-sacrifice. The sales department was unique and had been of enormous benefit to the undertaking; one firm alone had placed an order worth £1,300. Incandescent gas and Osram lamps had been tested in an independent laboratory, with gas at 2s. 6d. and electrical energy at 3½d.; the total cost of lighting was the same in each case. Their power consumers, who were big ratepayers, were themselves canvassing for the undertaking, and bringing works into the district. There would be a handsome profit balance at the end of the current year—over £2,000. Having been given powers to supply electricity, it was essential that they should have as full facilities for trading as any company would have.

Mr. W. A. Gilbert proposed "The Visitors" in a neat speech, and Mr. Alderman Spratt responded, taking occasion once more to dissociate the borough from the West Ham Union. A capital and lengthy programme of musical entertainments was provided, and the function was a complete success in every way.

Electric Supply Football League.—The only match for this month in the above League takes place to-morrow (Saturday) at Willesden, when St. James' Electric entertain St. Pancras Electric. The kick-off is fixed for 3 p.m.

A Council meeting of this League will be held on Tuesday next, February 11th, at 7 p.m., in the offices of the St. James' Electric Supply Co., Ltd., 19, Carnaby Street, W.

Mine Explosion.—An explosion involving the death of two men and the serious injury of many others occurred on Sunday night at a pit belonging to the Fife Coal Co. at Lochgelly. The explosion, *it is supposed*, says our local correspondent, was caused by a spark from an electrical machine used for driving a fan, igniting an accumulation of fire-damp. The motor is situated about 50 ft. from the shaft, but such was the force of the explosion that it hurled three men down the shaft.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station Officials.—The Manchester Electricity Committee has recommended, for the consideration of the City Council, increases of salary to several officials of this department, including MR. E. BOLTON, sub-station engineer; MR. J. A. CONSTANTINE, mechanical engineer, city stations; MR. H. A. RADCLIFFE, superintendent of the testing department; MR. H. LAMB, assistant resident engineer, Stuart Street; MR. E. J. CONSTABLE, assistant resident engineer, city stations; MR. A. CLARKE, district mains engineer, and others. MR. F. H. WHYSALL, resident engineer at Dickinson Street and Bloom Street stations, had agreed to an arrangement by which he will remain in the service of the Corporation for a period of three years; a maximum salary of £425 is to be reached by successive yearly advances from March 31st next.

Cheltenham T.C. on Monday referred back to the Electricity Committee a recommendation to increase the salary of the electrical engineer (MR. W. J. BACHE) from £400 to £500 per annum.

Out of five applicants MR. E. SMART has been appointed E.L. canvasser by the York Corporation Electricity Committee.

The Barrow Corporation has appointed MR. F. T. GRIFFIN-CHAVE as its canvasser.

York Electricity Committee has recommended the T.C. to increase the salary of Mr. Nichols, mains superintendent, from £91 to £110 per annum.

Mr. N. C. Rowan has left the Sheffield Tramways power station to take up an appointment with the Cleveland and Durham Electric Power, Ltd., of Middlesbrough.

The Eccles Electricity Committee has recommended the Town Council to increase the salaries of Mr. Frank Clark (chief clerk), Mr. E. J. Ward (senior shift engineer), and Mr. C. W. Marsland (shift engineer).

Tramway Officials.—The salary of the manager (Mr. F. Schofield) of the Leyton tramway undertaking is to be increased from £300 per annum, by £25 from the 1st prox, and is to rise afterwards by annual increments of £25 to a maximum of £400. The salary of Mr. J. Cornell, head clerk of the tramways depôt, is to be increased from £130 by £10 from the 1st prox., and is to rise afterwards by annual increments of £10, to a maximum of £180.

Mr. H. S. May, who is at present engaged as engineer and rolling stock superintendent in the tramways department of the Blackpool Corporation, is proposed by the Highways Committee of the L.C.C., as assistant rolling stock superintendent in the tramways department, in the place of Mr. W. E. Ireland, who is to be promoted to the office of rolling stock superintendent.

General.—Mr. Alex. Boyek has been appointed commercial manager of the Carron Co.'s new foundry at Carron. Mr. Boyek has represented the Carron Co. in London and Birmingham for several years.

Mr. S. M. Hopewell, of the General Electric Co., has been appointed chief engineer to the Gaiety Hotel and Restaurant, Strand, W.C.

We are asked to announce that Mr. Edw. J. Hogan, who has been identified with the Sunbeam Lamp Co. since its inception, has now severed his connection with that company, and is opening offices in Charing Cross Road, where he is representing several manufacturing firms.

Obituary.—The death occurred on 2nd inst. at Belfast of Mr. John Woodside, A.M.I.C.E., the cause being heart failure following an attack of quinsy. Mr. Woodside had carried out many important electrical installations, including those of the Belfast and Sheffield Hippodromes, Purdysburn Asylum, and numerous mills and factories in the North of Ireland. He was in his 37th year.

We learn from the borough electrical engineer of Shoreditch of the death of Mr. John Lawson, who for some years held the position of resident mechanical engineer in charge of the Whiston Street generating station.

CITY NOTES.

Yorkshire Electric Power Co., Ltd.

The directors, in their half-yearly report to December, 1907, present accounts showing a steady and progressive improvement in the company's business. The profit on the revenue account amounts to £836 10s., as against a loss of £403 for the preceding half-year. After payment of mortgage interest, the net revenue account shows a loss on the half-year of £139, as against a loss of £1,211 for the half-year ending June 30th, 1907. The loss made in the half-year occurred during the earlier part of that period; during the last three months, the receipts have not only met all current expenses, but have been more than sufficient to cover mortgage interest in addition. The demand for energy from the company's mains is steadily increasing, thereby reducing the average cost of production of each unit, and thus substantially improving the company's position. The growth of revenue up to date is clearly shown by a diagram in the report, and the directors anticipate with confidence profitable and continuous progress of the company's business for the year 1908. Up to December 31st last, agreements had been entered into with consumers for a total of 5,548 kw. (7,437 h.p.), being an increase of 2,426 kw. (3,252 h.p.) during the six months, which is a considerably larger increase than in any previous half-year. Amongst these new agreements is one with the British Carbide Factories, Ltd., who have leased for a number of years a portion of the company's land in close proximity to the generating station, and are now erecting buildings thereon, in which calcium carbide will be manufactured on a large scale for the first time in Great Britain. They have contracted to take their supply of current from the company, and will be important consumers. The districts supplied by the company present many advantages to manufacturers who are considering the erection of new works. Cheap land, low rates, plentiful labour and excellent transport facilities are considerations which the directors believe will lead to a considerable development of new industries. A supply of energy is now being given to the Electrical Distribution of Yorkshire, Ltd., in Farsley, Gomersal, Horsforth and Liversedge, and a supply will also be given to the company in Calverley at an early date. During the half-year the Ravensthorpe U.D.C. has commenced to take a bulk supply of energy. The agreement with that Council, as in the case of the agreements with the Pudsey Corporation and the Mirfield U.D.C., provides that the company may give a supply for power purposes direct to large power-users. Terms have been arranged with the Brighouse Corporation, by which they will close down their present generating station and will take their energy for tramway, power and lighting services direct from this company. As the company has now reached the position of meeting expenditure out of revenue, the directors suggest that in future the general custom of electrical and industrial companies shall be followed, and the report and statement of accounts issued to the shareholders yearly instead of half-yearly, as hitherto. A resolution to this effect will be submitted for the consideration of shareholders on February 18th. Mr. W. P. J. Fawcus has found it necessary, owing to continued absence abroad, to retire from the position on the board, which he has held from the beginning of the company.

Growth of Revenue and Decrease of Loss Compared.

Half-year ending—	Revenue.	Loss.	
December 31st, 1905	£1,297	£2,408	
June 30th, 1906	2,475	1,684	(including £45 mortgage interest)
December 31st, 1906	3,523	1,364	,, £443 ,,
June 30th, 1907	4,700	1,211	,, £808 ,,
December 31st, 1907	7,294	139	(after paying £975

Liverpool Overhead Railway Co.

The half-yearly report of the directors shows that the gross revenue receipts amounted to £41,136, and the working expenses to £32,154.

The number of passengers carried during the last two years was as follows:—

	Half-year ending June 30th, 1906.	Half-year ending Dec. 31st, 1906.	Half-year ending June 30th, 1907.	Half-year ending Dec. 31st, 1907.
First class	608,870	630,562	615,690	695,086
Third class (including tramways)	3,036,003	3,362,441	3,190,871	3,529,291
Workmen (special return tickets)	1,800,227	1,540,550	1,617,084	1,640,252
Total	5,445,100	5,533,553	5,423,595	5,804,629

Some improvement in the traffic is reported. The increase in the expenses is mainly owing to additional cost of coal and stores. Receipts from passenger traffic amount to £40,136, miscellaneous receipts and interest, £1,000; less working expenses and transfer to renewal fund, £32,154; and interest on mortgage debentures, and on calls paid in advance, £4,329; leaving £4,652 plus balance brought forward of £4,452; making a total of £9,105 available for dividend. Out of this balance dividends at the following rates (less income-tax), payable on and after February 14th next are recommended:—5 per cent. per annum on preference shares, £3,676; ½ per cent. per annum on ordinary shares, £1,250; leaving a balance of £4,179 to be carried forward. Mr. H. Brocklebank does not seek re-election as a director.

	Half-year ended Dec. 31st, 1906.	Dec. 1907.
Passenger train mileage	434,387	411,085
Tramway mileage	141,280	143,180

Blackpool and Fleetwood Tramroad Co., Ltd.

The directors, in their report for the half-year ending December 31st last, state that, including the sum brought forward, the balance of profit, after providing for debenture interest, is £12,537; and they recommend a dividend at the rate of 9 per cent. per annum. This will absorb £6,750; besides which £2,500 will be written off for depreciation, and an addition will be made to the general reserve account of £878, leaving a balance of £2,408 to be carried forward. The number of passengers carried during the half-year was 1,799,442, and the receipts from all sources were £23,869.

National Gas Engine Co., Ltd.

The directors' report for the year ended December 31st, 1907, shows a net profit, after providing amply for depreciation of buildings, tools, &c., and allowing for management salaries, of £61,559. An interim dividend for the six months to June 30th, amounting to £18,169, being at the rate of 5½ per cent. per annum on the preference shares, and 20 per cent. per annum on the ordinary shares, was paid on July 31st, 1907. The sum of £684 has been appropriated to the writing down of Consols to 85 per cent. (market price), leaving a balance of £42,705, to which must be added £9,975 brought forward from last year, making a total of £52,680 to be dealt with. Final dividends at the rate of 5½ per cent. per annum on the preference shares, and 20 per cent. per annum on the ordinary shares, less income-tax, for the six months ending December 31st, 1907, and a bonus of 1s. per share on the ordinary shares are recommended. This will absorb £25,669; £10,000 is to be placed to the reserve fund (making it £80,000), and £17,011 is carried forward. The death occurred in November last of Mr. F. H. Orme, who since the inception of the company had been a most valuable member of the board.

Anglo-American Telegraph Co., Ltd.

The directors' report, which is to be submitted to the meeting to-day, shows that the total receipts for the last half-year, including the balance of £24,143 brought forward, amounted to £235,935. The traffic receipts show a decrease of £7,798 as compared with the half-year ended December 31st, 1906. The working expenses of the half-year, as shown by the revenue account, amounted to £73,457, being a decrease of £3,050 as compared with the corresponding period of 1906. The directors have, before declaring the net profits, set apart the sum of £20,000 to the renewal fund, leaving a balance of £142,479. Quarterly interim dividends of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, were paid on November 1st, absorbing £52,500, leaving a balance of £89,979, out of which final dividends of £1 5s.

per cent. on the ordinary stock, £1 10s. per cent. on the preferred stock, and £1 per cent. on the deferred stock, payable on February 8th, amounting together to £87,500, are recommended, making a total distribution for the year ended December 31st, 1907, of £3 10s. per cent. on the ordinary stock, £6 per cent. on the preferred stock, and £1 per cent. on the deferred stock. The balance of £2,479 is carried forward. The renewal fund has been debited with £90,000 as a provision on account of depreciation of the securities, and this sum has been deducted from the cost of "sundry securities" in the balance sheet and carried to a depreciation account.

City and South London Railway Co.

The directors' report for the half-year ending December 31st, 1907, to be submitted to the half-yearly meeting on Tuesday, February 11th, shows receipts from all sources amounting to £89,150, while the cost of working has been £41,387, leaving a profit of £47,763. Inclusive of the balance brought forward from June 30th last, the net revenue account shows an aggregate total of £49,620. After making provision for the debenture stock interest, rent charge, and the transfer to the renewal fund of £1,500, a balance remains available for dividend of £34,070. Out of this sum the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896, 1901 and 1903, and that a dividend at the rate of 1⅝ per cent. per annum be paid upon the consolidated ordinary stock for the half-year, leaving £1,120 to be carried forward.

Half-year.	Passengers (exclusive of season tic. hldrs.).	Receipts (including season tckts.).	Dividend % p.a. on ord. stock.
Ended June 30th, 1905 ..	8,662,588 ..	£71,802 7 8 ..	2
,, December 31st, 1905..	8,607,486 ..	70,103 14 4 ..	1⅜
,, June 30th, 1906 ..	9,045,120 ..	72,454 3 11 ..	2¼
,, December 31st, 1906..	9,104,298 ..	72,228 2 4 ..	2
,, June 30th, 1907 ..	10,048,780 ..	77,519 11 9 ..	2½
,, December 31st, 1907..	10,732,145 ..	83,451 16 4 ..	1⅝
Total since opening of line..	190,909,526	£1,523,176 9 4	

Owing to the abnormally high cost of coal and general stores, and also to the competition with the electric tramways in the north of London, the directors are unable to maintain the increased rate of dividend on the ordinary stock that they were able to recommend for the corresponding period of last year. Concerted arrangements have been entered into with all the tube railways and the Metropolitan and District Companies for exhibiting a combined large map, and for the gratuitous distribution of small folder maps, as well as for advertising generally. By this means it is hoped to educate travellers to make more use of the intercommunication between the various underground systems. Through bookings, of a kind likely to be of great convenience to the public, have been arranged between this company's line and the suburban stations on the Great Northern and Midland Railways, also with the Metropolitan Railway and the Central London, Hampstead (and Highgate) and Piccadilly Tubes. These are in addition to the previously arranged through bookings with the Brighton Railway and the Baker Street and Waterloo and Great Northern and City Tubes. Two additional new steel five-coach trains have just been delivered by the Brush Co. One of these has been put into the traffic, and the other will follow in a few days. The additional engine required at the generating station for the Euston extension has been erected and is at work.

Train Mileage.—Passenger Trains.

Half-year to December, 1906... ... 552,048 train miles.
,, ,, 1907... ... 683,950 ,,

Central London Railway Co.

The directors report that the capital expended during the half-year ending December 31st, 1907, was £19,482, the chief items being for the additional generating plant at the power house, and the new line at Shepherd's Bush. Compared with the corresponding period in 1906 there was a decrease of £18,508 in the revenue receipts, and of £5,153 in the working expenses; rates and taxes have decreased by £168 10s. The available balance is £59,621. The number of passengers carried since the opening of the railway, including those using the cheap return tickets issued before 7.30 a.m., is as follows:—

Year.	Half-year ending June.	Half-year ending December.	Total.
1900	—	14,916,922*	14,916,922
1901	20,385,739	20,802,650	41,188,389
1902	22,879,334	22,425,776	45,305,110
1903	23,179,138	21,774,850	44,953,988
1904	22,969,397	21,906,150	44,875,547
1905	23,067,435	21,694,066	44,761,501
1906	22,336,489	20,721,508	43,057,997
1907	20,200,871	16,646,620	36,907,491
		Total number carried.. ..	315,936,945

* Five months from July 30th.

The decrease in the number of ordinary passengers carried during the half-year is 3,710,636, and of workmen 364,252, the total decrease being 4,074,888 or 19·67 per cent., compared with the corresponding period. A modified system of fares was adopted from July 1st last. An arrangement, subject to one month's notice, has been entered into with the omnibus companies, in accordance with which they have reduced the length of their penny fare sections on the route of the Central London Railway, the latter retaining the minimum fare of 2d. The new fares came into operation on December 15th last. The average receipt per passenger for the half-year is 2·01d. as compared with 1·84d. in the half-year ending December, 1906. The cost per passenger is 1·28d. as compared with 1·09d. in the corresponding period. Continued attention has been given to the reduction of the working expenditure, to lessen, as far as possible, the loss resulting from the diversion of traffic by omnibus and other surface competition, as well as from the opening and development of other tube railways; and with the same view, improvements in the working and controlling of the trains have been adopted. Through bookings are now in operation between the Baker Street and Waterloo, the Charing Cross, Euston and Hampstead, and the Central London Railways. Similar arrangements are also being made with the Great Northern, Piccadilly and Brompton, and the City and South London Railways. At the present time some 10,000 to 12,000 through passengers are carried daily. The number is steadily increasing, and there is little doubt that the public appreciate and will utilise the facilities afforded. After providing for interest on the debenture stock and other payments, the net revenue, including £25,891 brought in from previous half-year, shows a balance of £70,750. The directors recommend the declaration of the following dividends:—On the undivided ordinary stock at the rate of 3 per cent. per annum for the half-year; on the preferred ordinary stock at the rate of 4 per cent. per annum for the half-year; on the deferred ordinary stock at the rate of 2 per cent. per annum for the *whole* year. After providing for these payments there remains a balance of £20,218. The directors recommend that of this balance £10,000 be credited to the reserve fund, the £10,218 remaining to be carried forward to next half-year. They also propose that the outstanding accounts for Parliamentary expenses incurred in the promotion of the company's Bills in the Sessions 1901 to 1905 be now cleared, and that the amount £25,367 be charged to the reserve fund, leaving a credit balance of £72,880 at that account. The locomotive account placed in suspense in 1903, pending the sale of the materials of the superseded engines, is now closed, and the balance of £66,590 has been re-transferred to the capital account. The line from Shepherd's Bush Station to the depôt is in course of construction, and is to be completed in time for the opening of the Franco-British Exhibition in May next. A new station is being provided, immediately opposite the entrance to the exhibition. This extension, with the present line from Shepherd's Bush Station to the depôt yard, will form a complete loop, and will greatly facilitate the working of the service generally, as well as the traffic to and from the exhibition. Combined tickets covering the railway journey and admission to the exhibition will be sold at the company's booking offices. As the outcome of the conferences held in October and November last between the representatives of the Board of Trade, the principal railway companies and the Amalgamated Society of Railway Servants, it was agreed to establish conciliation boards to deal with disputes affecting railway servants. The directors of the Central London Co. were not represented at these conferences, but they have been asked by the Board of Trade to become parties to the agreement, and the subject is receiving careful attention.

Our report of the meeting held on Wednesday will appear next week.

Metropolitan Railway Co.

Sir Charles McLaren, Bart., M.P., presided on Wednesday last week, at the Great Eastern Hotel, over the half-yearly meeting, and in moving the adoption of the report (see Electrical Review, January 31st, page 190) said there was an increase in the receipts of £3,775, exclusive of their proportion of the receipts from the joint line which they shared with the Great Central Co. The increase from passenger traffic amounted to £1,412, but this came wholly from season tickets, which showed an advance of £3,043, the ordinary passenger receipts having declined by £1,631. The declension was in the first and second-class traffic, which together showed a falling-off of £10,545, while the third-class earnings had grown by £8,913. These fluctuations in receipts were also reflected in the number of passengers carried, the first class having diminished by 425,706, and the second class by 719,880, the third class showing a slight increase of 14,546. Their ordinary passengers were fewer by 1,131,040 than in 1906. Various causes had contributed to the decreases. In the first place the multiplication of tubes in London, having only one class of car, tended to discourage the habit of paying a higher fare on those lines such as theirs where more than one class of accommodation was still provided. So far as the second class was concerned, their electric trains made no provision for that class of passenger, and by far the larger number of those who formerly travelled second class now availed themselves of the equally good accommodation which was supplied in the third-class cars, and this had led to a loss of revenue. Again, the fact that they had found it necessary to increase a number of the fares, which experience had taught them were too low, had tended to discourage the first-class traffic. The little second-class traffic they now had was carried in the trains of other companies and not in their own. With regard to third class, the increase in fares had helped them materially in the past half-year, but they had felt very seriously the effects of new competition, notably from the Great Northern and Piccadilly, and the City and South London Railways, as well as the London County Council Electric Tramways, the receipts at one station alone, viz., King's Cross, having fallen several thousand pounds; but at their other stations on the Circle and the St. John's Wood Line there had been most satisfactory increases which had more than compensated for this loss. It was gratifying, moreover, that the season-ticket traffic showed a substantial increase, the receipts having

advanced by about 8 per cent., and the number of passengers by over 3 per cent. The effect of the small advance in fares which they made in co-operation with other London companies, had increased the average receipt per passenger from 1·377d. to 1·407d., that was for the whole number carried. The percentages for the various classes were: first class, 7·94 compared with 8·84; second class, 4·09 compared with 6·52; third class, 87·97 compared with 84·64. The parcels receipts had fallen slightly by £119; the earnings from merchandise by £742, chiefly due to less traffic being carried over their widened lines by the Great Northern and Midland Companies. Live stock receipts were less by £25, but the mineral traffic earnings are £2,518 better. Rents showed an increase of £717, and transfer fees £14. From these various sources, therefore, they were able to show an augmentation in their revenue of £3,775. Turning to the expenditure side of the account, maintenance of permanent way, works and stations, showed a saving of £1,982, while locomotive and generating expenses had increased by £4,754, which was due partly to an addition of 351,000 train-miles run, but more particularly to the high prices ruling for coal, for under this head alone, there was an increase for the half-year of £4,188. Railway companies generally had had to suffer very seriously during the past half-year on this account. They had been very fortunate in having got a contract for most of their power house coal before the rise in prices. Carriage and wagon repairs show a decline of £1,766; traffic expenses were practically the same; general charges were £1,073 more; and law expenses, owing to less Parliamentary work, were £544 down. Of the remaining items the only one calling for special remark was rates and taxes, where a decrease, on comparison, of £4,513 is shown. While this was satisfactory so far, he might say that the question of the rating of railways was one which shareholders should very seriously consider and give as much help as possible to the directors. The balance of account for working trains for other companies showed an increased credit of £4,427, a portion of which was due to their having made an arrangement with the District Co. to provide the whole of the Inner Circle train service with their own stock, instead of the District trains working over their line. They were thus able to reduce their net expenditure by £5,915, and he was pleased to say that the percentage of expenses to receipts had been brought down from 62·19 per cent. to 59·76 per cent., a saving of 2·43 per cent., which he hoped they would agree was a very satisfactory feature. The gain in receipts and curtailment of expenditure enabled them to increase the amount taken to the net revenue account by £9,690. They received £823 more from the joint circle City lines, and from the joint line beyond Harrow, which was formerly their Northern extension, an additional sum of nearly £6,000. The out-goings for debenture interest, rents and rent charges, too, had grown by fully £5,000. They started last year the electrical renewal and depreciation fund in order to provide for the renewal of their electrial plant and stock, and to this fund they had carried from revenue a sum of £6,000. They were left then with a balance available for dividend of £124,357, or almost the same amount as a year ago, and after providing for the dividends on the preference stocks, recommended the payment of a dividend on the ordinary stock at the rate of 10s. per cent. per annum, leaving a balance to be carried forward to the next half-year's accounts of £5,516, or slightly less than the amount carried forward at the close of 1906. As to the competition which they had to face from tubes, motor-omnibuses and the electric trams, there was no doubt that for the time being the supply of travelling facilities had outrun the demand, but now that they had got in London, systems of conveyance which were different, but still as comprehensive as those in New York, they might confidently expect to see a very large increase indeed in the travelling habit of the people. Moreover, some of the "tube" railways were acting as feeders to their line, especially at Baker Street in connection with the St. John's Wood line, so that although they had suffered a loss of traffic at certain stations, and on certain routes, particularly at King's Cross, through the competition of the Great Northern, Piccadilly and Brompton tube and the extension to Euston of the City and South London line, still they had every confidence that the loss in these directions would be more than compensated for by the growth in the traffic generally, induced by the large increase in the facilities afforded. Taking all the facts into account, he thought, without being too optimistic, that their prospects for the future were considerably brighter than they had been for some time past. They were approaching the end of their capital expenditure on the electrification of the line, because, when the extension of the power station at Neasden, which was now proceeding, was completed, and the additional machinery was installed, they would have a plant that would meet all their requirements, so far as it was possible to foresee, for many years to come.

Sir W. Birt seconded the motion.

Several shareholders urged the board to consider the question of further raising the fares so that the ordinary shareholders might derive some benefit from their investment.

The Chairman said they would like to increase the fares, if the public would pay them, but they must get their competitors into line.

The report was adopted.

Prospectuses.—*Montreal Street Railway Co.*—Yesterday the list of applications was to close for an issue of £460,000—4½ per cent. sterling debentures at 96 per cent.

R. & J. Dick, Ltd.—This company has been before the public with an issue of 325,000—5½ per cent. cum. pref. shares of £1 each.

Metropolitan Railway Co.—Applications are being invited until 12th inst. for an issue of £498,581—3½ per cent. "A" debenture stock.

Giants' Causeway and Portrush Electric Tramway Co., Ltd.—At a general meeting held on January 30th, the directors reported a decrease of 15,000 in passengers and a falling off in the year's receipts compared with 1906, of £385, explained by the unfavourable season, the International Exhibition, and the prolonged strike in Belfast, preventing working class excursions. A large increase in the coming season is expected.

Oxford Electric Co., Ltd.—Subject to final audit, the directors recommend a dividend of 7 per cent. per annum on the ordinary share capital for the year ending December 31st, 1907, free of income-tax (including the interim dividend of 2½ per cent. paid in September last), and a dividend on the preference shares at the rate of 5 per cent. per annum. Last year the ordinary dividend was at the same rate.

Great Northern and City Railway Co.—The report for the half-year ended December 31st last, states that the total revenue receipts for the six months amounted to £47,582, and the cost of working to £24,778, being at the rate of 52·07 per cent. Inclusive of the balance brought forward from June 30th last, and after providing for interest on debenture stock and other charges, and setting aside £500 to renewal fund, there remains a balance of £379, which the directors recommend be carried forward. The number of passengers for the six months, including season-ticket holders, was 7,543,174, as against 7,901,923 for the corresponding period last year. The number of local season-tickets issued during the half-year was 3,703, as against 3,013 for the half-year ended December 31st, 1906. The number of three-route season-ticket holders using the company's line during the past half-year was 2,565. The directors, after consideration, and in conjunction with the Great Northern Railway, decided upon a revision of fares which involved certain increases. This new arrangement came into operation on November 1st, 1907. The effect has been to a large extent to check the decline in revenue arising from the severe competition which the company has had to contend with during the past half-year. The meeting was held yesterday.

Westminster Electric Supply Corporation, Ltd.—An extraordinary general meeting of the shareholders of this company was held on Wednesday at the offices, Eccleston Place, S.W., Lord Suffield presiding, when the following resolution was unanimously agreed to:—

That a Bill to confer further powers upon the Kensington and Knightsbridge Electric Lighting Co., Ltd.; the Notting Hill Electric Lighting Co., Ltd.; the St. James' and Pall Mall Electric Light Co., Ltd.; the Westminster Electric Supply Corporation, Ltd.; and the Central Electric Supply Co., Ltd., with respect to the supply of electrical energy and for other purposes, subject to such additions, alterations or variations as are made, or Parliament may think fit to make therein, be and the same is hereby approved.

The directors recommend a dividend at the rate of 10 per cent. per annum (less income-tax) for the half-year ended December 31st last. Last year the final dividend was at the rate of 13 per cent. per annum, making the total 12 per cent. for the year.

Power Gas Corporation, Ltd.—In their annual report the directors state that the A.B.P. Accumulator Co., Ltd., has now been liquidated voluntarily, involving a net loss of £16,822, which has been temporarily placed to a suspense account in the books of Ashmore, Benson, Pease & Co., Ltd.

National Telephone Co., Ltd.—The directors have resolved, subject to final audit, to recommend the following dividend for the half year ending December 31st, 1907, after payment of the dividends on the preference shares: at the rate of 6 per cent. per annum on the preferred stock, at the rate of 6 per cent. per annum on the deferred stock, less income-tax in all cases, carrying £145,000 to reserve, and about £10,000 forward. The transfer books of the company will be closed from the 7th to the 20th prox., both days inclusive, and the dividend warrants will be posted on the latter date. For the corresponding period of 1906 the "deferred" share dividend was 5½ per cent. per annum. £135,000 was carried to reserve and £10,000 carried forward.

Buenos Ayres Port and City Tramways, Ltd.—Mr. G. Kitchin presided at the meeting of this company held on 3rd inst. at 2, Broad Street Place, E.C. He said that since the accounts were made up a considerable amount of money had been expended on construction work, and he was pleased to say that the line was now nearing completion. In the last monthly report, their engineers (Messrs. Kincaid, Waller, Manville & Dawson) stated that, as most of the outstanding matters which were formerly delaying completion were now being settled, there was nothing to prevent the construction work being completed at an early date. Instead of the line being constructed and open for work in 18 months, two and a half years had elapsed since the prospectus was issued.

Notting Hill Electric Lighting Co., Ltd.—This company held an extraordinary general meeting on the 3rd inst. Sir William Crookes explained that the subject of the meeting was to consider a resolution to approve a Bill to confer further powers upon the Kensington and Knightsbridge Co., the Notting Hill Co., the St. James' and Pall Mall Co., the Westminster Electric Supply Corporation and the Central Electric Supply Co., with respect to the supply of electrical energy and for other purposes. The companies concerned were asking for power to associate for the purpose of supplying power in bulk and laying mains for that purpose. By enlarging the area over which they supplied electricity, and federating with neighbouring companies, they hoped to reduce the cost of supply, and, by reductions in the charges they made for current, extend their business. The resolution was adopted.

MARKET QUOTATIONS.

Wednesday, February 5th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a ,, Nitric .. .. .. per cwt.	22/-	..
a ,, Oxalic .. .. per cwt.	38/-	..
a ,, Sulphuric .. .. .. per cwt.	5/6	..
a Ammoniac, Sal .. .. .. per cwt.	42/-	..
a Ammonia, Muriate (crystal) .. per ton	£33 10	..
a ,, ,, ... per ton	£30	..
Bleaching powder .. .. per ton	£5 10	..
a Bisulphide of Carbon .. .. per ton	£18	..
a Borax .. .. per ton	£16	..
a Copper Sulphate .. .. .. per ton	£24	..
a Lead, Nitrate .. .. .. per ton	£31	..
a ,, White Sugar .. .. .. per ton	£28	..
a ,, Peroxide .. .. .. per ton	£32	..
a Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium Bichromate, in casks per lb.	8½d.	..
a Potash, Caustic (75/80 %) .. per ton	£20	..
a ,, Chlorate .. .. per lb.	3½d.	..
a ,, Perchlorate .. .. per lb.	9d.	..
a Potassium Cyanide .. .. per lb.	7d.	..
a Shellac .. .. per cwt.	125/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. per ton	£6 10	..
a ,, Recovered .. .. per ton	£5 10	..
a ,, Lump .. .. .. per ton	£5	..
a Soda, Caustic (white 70 %) .. per ton	£10 15	..
a ,, Chlorate .. .. .. per lb.	3½d.	..
a ,, Crystals .. .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. per lb.	3d.	..
a ,, Cyanide (basis 100 %) .. per lb.	7d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£168	..
b ,, Wire, in ton lots .. per ton	£150	..
b ,, Sheet, in ton lots .. per ton	£145	..
b Babbitt's metal ingots .. .. per ton	£50 to £125	..
c Brass (rolled metal 2" to 12") basis per lb.	7d.	..
c ,, Tube (brazed) .. .. per lb.	9¼d.	..
c ,, ,, (solid drawn) .. .. per lb.	8¼d.	..
c ,, Wire, basis .. .. .. per lb.	7⅞d.	..
c Copper Tubes (brazed) .. .. per lb.	10¼d.	..
c ,, ,, (solid drawn) .. per lb.	10¼d.	..
g Copper Bars (best selected) .. per ton	£80	..
g Copper Sheet .. .. .. per ton	£80	..
g ,, Rod .. .. per ton	£80	..
c ,, (Electrolytic) Bars .. per ton	£65	£1 dec.
c ,, ,, Sheets .. per ton	£82	£1 dec.
c ,, ,, Rod .. per ton	£71	£1 dec.
c ,, ,, H.C. Wire per lb.	8¾d.	¼d. dec.
f Ebonite Rod .. .. .. per lb.	3/3	..
f ,, Sheet .. .. .. per lb.	3/-	..
n German Silver Wire .. .. per lb.	1/7	½d. inc.
h Gutta-percha, fine .. .. per lb.	5/6 to 6/6	..
h India-rubber, Para fine .. .. per lb.	3/1½	dec.
i Iron Pig (Cleveland warrants) .. per ton	48/6	6d. inc.
l ,, Wire, galv. No. 8, P.O. qual. per ton	£15	..
g Lead, English Ingot .. .. per ton	£15 5 to £15 10	10/- inc.
g ,, ,, Sheet .. .. per ton	£15 9 to £16 14	10/- inc.
m Manganin Wire No. 28 .. .. per lb.	8/-	..
g Mercury .. .. per bot.	£8 5	..
d Mica (in original cases) small .. per lb.	6d. to 1/-	..
d ,, ,, ,, medium per lb.	2/6 to 4/-	..
d ,, ,, ,, large .. per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings per lb.	1/1 to 1/2	..
p ,, rolled bars & rods per lb.	1/2 to 1/3	..
p ,, ,, strip & sheet per lb.	1/2½ to 1/5	..
o Platinum .. .. per oz.	110/-	..
e Silicium Bronze Wire .. .. per lb.	10d.	..
r Steel, Magnet, in bars	£60	..
g Tin, Block (English) .. .. per ton	£131 to £132	£5 inc.
n ,, Wire, Nos. 1 to 16 .. .. per lb.	1/9½	..
p White Anti-friction Metals—		
"White Ant" brand .. .. per ton	£40 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.) per ton	£25	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Dublin United Tramways Co. (1896), Ltd.—The report for the half-year ended December 31st states that £64,840 is available for division. Dividends for the half-year at the rate of 6 per cent. per annum, free of income-tax, on the ordinary shares, together with a bonus of 1s. per share, also free of income-tax, on the ordinary shares, are recommended; £5,000 is placed to reserve and renewals fund, £1,000 to accident insurance fund, £10,000 towards reconstruction and maintenance, and £2,000 as further provision against the guarantee to the Irish International Exhibition (1907), in addition to the £6,250 already paid in respect of this guarantee and charged to revenue in these accounts; £8,740 is to be carried forward.

City of Buenos Ayres Tramways Co., Ltd.—For the year ended December 31st a balance dividend of 1s. 3d. per share is recommended, £3,600 being transferred to the general amortisation fund, and £144 carried forward.

STOCKS AND SHARES.

Tuesday Evening.

MONETARY conditions remaining tranquil, the stock markets are featured this week by a further series of improvements in the prices of investment securities. Consols led a sharp rise on Monday last, and the inclination amongst buyers is to seek the best-class issues. Consequently, prior-charge stocks are the subject of brisk demand. Preference and Ordinary shares, however, have by no means lagged behind. It may be said that the buying shows a healthy tendency to broaden—a tendency backed by the hope of another fall in the Bank Rate taking place before long.

This week's new issue of most interest to those who especially follow electrical work is the £460,000 4½ per cent. Debentures offered at 96 by the Montreal Street Railway Co. The Debentures are attractive in several respects.

Electricity supply stocks and shares have halted, for the time being, on their improving path. The Westminster Electric Corporation disappointed some of its supporters by the declaration of a 5s. dividend, making 10 per cent. for the year, as against the previously paid 12 per cent. This caused Westminster Ordinary to drop 10s. Charing Cross Ordinary are a little lower after their recent swift advance. County of London issues are better; all four show gains, and City of London second Debenture rose a point. An equal rise took place in Midland Electric 4½ per cent. Debenture stock. Notting Hill shares, somewhat overlooked in the latest outburst of buoyancy, put on 5s., and several provincial shares have come into request locally. Folkestones and Oxfords are each better on this account.

Domestic railway stocks have been very despondent, and only within the last day or two was there any attempt to invigorate prices. City and South London has fallen 3, and Central London Deferred a point. Both stocks still carry the dividends. Metropolitan Consolidated at 38 is *ex.* the 5s. per cent. distribution, while Districts at 10½, to quote the bitter humour of a proprietor, are *cum.* dividend. Great Northern, Piccadilly and Brompton £10 Ordinary shares, fully paid, stand at 4—5, and business is being done in the 4 per cent. Debenture stock on the basis of 84—85. The Charing Cross and Hampstead 4 per cent. Debenture is some nine points lower than the Piccadilly stock.

The terrible tragedy in Portugal has not, of course, affected the Debenture stock of Anglo-Portuguese Telephone Co., although naturally it depressed Portuguese Government bonds. Telephone stocks are firm throughout, and the announcement of a 6 per cent. dividend on National Telephone Deferred, with very substantial appropriations to reserve and carry-forward, must excite satisfaction in the minds of holders. The stocks enjoyed their rise in advance of the declaration, so the Third Preference shares and the 4 per cent. Debenture stock are the only issues with quotable changes this week.

Telegraph stocks are good, and the chief features are rises of £3 in Great Northerns and £1 in Indo-Europeans. West India and Panama pursue their upward course, West Coast of America have rallied again, and Eastern Extension shares gained a fraction. In the American group, Anglo Preferred picked up ½, though the Deferred dropped ¼, and further buying orders from the United States, brought about a 4 points rise in Commercial Cable 4 per cent. Debenture stock.

Globe Telegraphs of both kinds are raised. Submarine Cables Trust certificates are a point to the good.

Tramway descriptions continue an improving market. Anglo-Argentine Second Preferences show a ⅛ gain, and the First Preferences at 6½ added the fraction. British Columbia stocks have been decidedly strong, Calcutta Trams are better, and British Electric Tractions found a few buyers. On the other hand, London United Preference and Dublin United Ordinary are 5s. lower.

Better demand for industrials has brought several electrical issues to the front. Callender's Preference hardened, and so did Henley's Debenture. British Insulated shares and Debenture have been advanced, but Westinghouse Debenture at 42½ is nominally 2½ lower. Brush Preference have rallied from their last week's fall.

Advance copies are in circulation of the Caribbean Anglo-Columbia Cable Co.'s issue, which will be offered to the public very shortly.

Metropolitan District Railway Co.—The directors have declared a dividend on the 4 per cent. guaranteed stock for the past half-year, at the rate of 1½ per cent. per annum. A year ago the rate was 1½ per cent. per annum.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Jan. 28th.	Closing Quotations Feb. 4th.	Business done week ended Feb. 4th, 1908. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2 — 3	2 — 3	..	..	..	Nil
143,800	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 14 11
$131,551,400	American Telephone & Telegraph, Cap. Stock	$100	7½%	7½%	8 %	..	110 —113	109 —113	..	..	— ½	7 1 7
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	..	86 — 88	86 — 88	..	..	..	4 10 11
622,600	Anglo-American Telegraph	Stock	2¾%	3½%	3¾%	3½%	57 — 60	57 — 60	57⅞	57⅛	..	5 16 8
3,188,700	Do. do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	101 —103	101⅛—103⅛	102⅞	100	+ ⅜	5 15 11
3,188,700	Do. do. do. Deferred	Stock	Nil	½ %	1¾%	1 %	16¼ — 17	16⅝ — 16⅞	16 7/16	16⅛	— ¼	5 15 9
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	..	99 —102	99 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	6⅞ — 7⅛	6⅞ — 7⅛	7⅛	..	..	5 10 4
2,300,459	Commercial Cable Sting. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	..	82 — 85	86 — 89	87⅛	84	+4	4 9 11
16,000	Cuba Telegraph	10	5 %	5 %	5 %	..	6½ — 7⅛	6½ — 7⅛	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	15⅝ — 16⅞	15⅝ — 16⅞	..	..	..	5 19 5
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	..	8¼ — 9⅛	8⅛ — 9⅛	..	..	..	5 5 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	..	98 —101	99 —102	..	..	+1	8 16 6
60,710	Direct United States Cable	20	3½%	4½%	4½%	..	13⅜ — 14¼	13⅜ — 14¼	14	13⅞	..	6 10 9
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	..	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	130 —135	130 —135	133	130	..	5 3 8
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	..	82 — 85	84 — 87	86	82½	+2	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	..	99 —102	100 —103	102½	101	+1	3 17 8
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	12⅜ — 12⅝	12½ — 13	12 31/32	12¼	+ ⅛	5 7 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —104	99 —102 xd	..	..	—2	3 18 5
286,800	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	99 —102	97 —100 xd	..	..	—2	4 0 0
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	99 —101	99 —101	..	..	..	15 17 0
181,127	Globe Telegraph and Trust	10	5⅝%	5½%	5½%	..	9⅞ — 10⅜	10 — 10½	10 5/16	10	+ ⅛	5 4 9
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	13⅛ — 13⅝	13½ — 14	13⅝	13 5/16	+ ¼	4 5 9
150,000	Great Northern Telegraph, of Copenhagen ..	20	24 %	24%	20 %	..	30 — 32	33 — 35	33¼	31½	+3	5 14 3
86,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	..	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	52 — 55	53 — 56	..	..	+1	6 13 11
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	..	58 — 61	58 — 63	..	..	..	5 11 1
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	..	61 — 67	61 — 67	..	..	..	5 19 5
384,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	5/16 — 7/16	5/16 — 7/16	15/-	..	+ 1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	..	1 3/16 — 1 5/16	1 3/16 — 1 5/16	20/7½	..	..	4 14 1
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	..	1 — 1	1 — 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	111 —113	111 —113	112	111	..	5 6 2
3,341,425	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	110 —112	110 —112	111½	110½	..	4 7 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	11 — 13	11 — 13	..	..	..	4 12 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10½ — 12½	10½ — 12½	..	..	..	4 0 0
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅝ — 5 7/16	5⅝ — 5⅝	5⅝	5⅝	+1/16	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99	97 — 99	97⅝	97½	..	3 11 1
1,710,093	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99½—101½	100⅛	100	+ ⅛	3 18 10
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6¾%	7 %	7 %	..	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	5 17 11
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	..	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	5 1 1
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	..	4 %	4 %	..	90 — 93	90 — 93	..	..	..	4 6 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	..	98 —101	98 —101	..	..	..	3 19 3
11,889	Reuter's	8	5 %	5 %	5 %	..	7 — 8	7 — 8	7⅞	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red. ..	100	..	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
3,167	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	125 —128	126 —129	..	..	+1	5 0 8
100,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅝ — 7	6⅝ — 7	..	..	..	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 15 3
15,609	West African Telegraph, Shares	10	4½%	4 %	4 %	..	10 — 10½	10 — 10½	..	..	..	3 16 2
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2	Nil	Nil	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	37/6	35/7½	+ ⅛	10 13 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	98 — 101	98 —101	..	..	..	3 19 3
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930. ..	10	7 %	7 %	7 %	..	12¾ — 13⅜	12¾ — 13⅜	13⅛	12⅝	..	5 4 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	..	98 —101	98 —101	99⅜	..	..	3 19 3
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	12/-	8/9	+ 1/16	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	..	7⅞ — 8	7⅞ — 8⅛	..	..	+ ⅛	9 13 11
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	7⅛ — 8	7⅛ — 8¼	7⅛	..	+ ¼	Nil
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	..	100 —103	98 —101	..	..	—2	4 19 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	8 %	..	7⅞ — 8⅛	8 1/16 — 8 3/16	8¼	8	+ 1/16	4 16 8
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	..	5⅞ — 6¼	6 — 6¼	6 3/32	6 1/16	+ ⅛	4 8 0
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	..	126 —131	126 —131	..	..	..	4 11 7
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	..	102 —105	102 —105	..	..	..	4 15 3
830,000	Babcock & Wilcox, 1 to 830,000	1	20	20	20	..	3⅛ — 3⅜	3⅛ — 3⅜	75/-	71/3	..	5 6 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	3 16 10
40,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	..	3⅝ — 4⅛	3⅝ — 4⅛	85/-	78/9	..	7 15 7
40,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	4⅛ — 5⅛	4⅛ — 5⅛	98/9	..	+ ⅜	6 13 4
20,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	5 11 8
20,000	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	..	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	4 14 1
238,200	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	100 —103	100 —103	..	..	..	5 13 5
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	5½%	5½%	98 —101	96 — 99 xd	99⅜	..	—2	5 11 1
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	..	125 —128	127 —130	127⅞	..	+2	4 12 4
300,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	..	105 —109	106 —110	106½	103½	+1	4 10 11
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	..	100 —104	103 —106	103⅝	103¼	+2½	4 14 4
225,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	..	100 —103	100 —103	102½	..	..	4 7 3
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
133,301	British Electric Traction	10	6 %	3 %	Nil	..	1¼ — 1⅜	1¼ — 1⅜	28/9	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	4⅛ — 4⅜	4⅜ — 5⅛	96/3	81/3	+ ⅜	11 14 2
1,448,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 95	93 — 97	96	95½	+2	5 3 1
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	68 — 73	70 — 74	69½	..	+1	6 1 7
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	..	6½ — 7	6⅝ — 7⅛	..	..	+ ⅛	7 0 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅝ — 6⅛	5⅝ — 6 xd	6	5 12/16	— ⅛	5 0 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102½	..	..	4 7 5
212,000	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	..	85 — 89	85 — 89	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	⅜ — 1	⅜ — 1	..	..	..	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	40 — 50	40 — 45	41	..	..	8 17 10
50,000	‡ Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
106,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	2½%	Nil	..	0— ¼	0 — ¼	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	..	¼ — ⅜	¼ — ⅜	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	..	83 — 86	82 — 85	..	..	—1	5 5 11
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	..	63 — 66	63 — 66	..	..	..	6 16 4
100,000	Buenos Ayres & Belgrano, 1 to 100,000 ..	5	4 %	3 %	3 %	..	4⅜ — 4⅞	4⅜ — 4⅞	23/9	..	..	3 1 6
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 14 3
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 14 3
310,000	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	..	110 —116	110 —116	..	..	..	4 6 2
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	..	102 —105	102 —105	..	..	..	4 15 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	8 %	..	6½ — 7	6⅝ — 7⅛	7 1/16	7	+ ⅛	5 10 4
80,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	..	5 %	5 %	..	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	4 13 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	..	101 —105	101 —105	..	..	..	4 5 9
25,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	..	9½ — 10⅛	9⅝ — 10⅛	10⅛	..	+ ⅛	6 6 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	..	104 —106	105 —107	..	..	+1	4 4 1
491,223	Cape E Trams., 1 to 491,223	1	5 %	Nil	Nil	..	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	..	1⅛ — 1⅜	1⅛ — 1⅜	25/9	..	..	5 16 4
215,045	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	100 —103 xd	..	..	—1	4 7 5
1,938,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	65 — 68	65 — 68	67⅛	66	..	4 8 3
558,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	85½	..	..	4 13 0
558,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	44 — 47	43 — 46	..	..	..	4 5 1
1,480,000	City and South London Railway	Stock	2⅛%	1⅞%	2⅛%	2⅛%	41 — 46	40 — 42	44	41	—4	5 1 2

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

MARKET QUOTATIONS.

Wednesday, February 5th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	,, Nitric	per cwt.	22/-	..
a	,, Oxalic	per cwt.	38/-	..
a	,, Sulphuric	per cwt.	5/6	..
a	Ammoniac, Sal	per cwt.	42/-	..
a	Ammonia, Muriate (crystal) ..	per ton	£38 10	..
a	,, ,, ...	per ton	£30	..
	Bleaching powder	per ton	£5 10	..
a	Bisulphide of Carbon	per ton	£18	..
a	Borax	per ton	£16	..
a	Copper Sulphate	per ton	£24	..
a	Lead, Nitrate	per ton	£31	..
a	,, White Sugar..	per ton	£28	..
a	,, Peroxide	per ton	£32	..
a	Methylated Spirit	per gal.	2/6	..
a	Potassium Bichromate, in casks	per lb.	5½d.	..
a	Potash, Caustic (75/80 %) ..	per ton	£20	..
a	,, Chlorate	per lb.	6½d.	..
a	,, Perchlorate	per b.	9d.	..
a	Potassium Cyanide	per lb.	7d.	..
a	Shellac	per cwt.	125/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a	,, Recovered	per ton	£5 10	..
a	,, Lump	per ton	£5	..
a	Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a	,, Chlorate	per lb.	8½d.	..
a	,, Crystals	per ton	£8 5	..
a	Sodium Bichromate, casks ..	per lb.	3d.	..
a	,, Cyanide (basis 100 %) ..	per lb.	7d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots ..	per ton	£108	..
b	,, Wire, in ton lots ..	per ton	£150	..
b	,, Sheet, in ton lots ..	per ton	£145	..
b	Babbitt's metal ingots	per ton	£50 to £125	..
c	Brass (rolled metal 2" to 12") basis	per lb.	7d.	..
c	,, Tube (brazed)	per lb.	9¼d.	..
c	,, ,, (solid drawn)..	per lb.	8¼d.	..
c	,, Wire, basis	per lb.	7¾d.	..
c	Copper Tubes (brazed)	per lb.	10½d.	..
c	,, ,, (solid drawn) ..	per lb.	10½d.	..
g	Copper Bars (best selected) ..	per ton	£80	..
g	Copper Sheet	per ton	£80	..
g	,, Rod	per ton	£80	..
c	,, (Electrolytic) Bars ..	per ton	£65	£1 dec.
c	,, ,, Sheets ..	per ton	£82	£1 dec.
c	,, ,, Rod ..	per ton	£71	£1 dec.
c	,, ,, H.C. Wire	per lb.	8¾d.	¼d. dec.
f	Ebonite Rod	per lb.	3/3	..
f	,, Sheet	per lb.	3/-	..
n	German Silver Wire	per lb.	1/7	..
h	Gutta-percha, fine	per lb.	5/6 to 6/6	½d. inc.
h	India-rubber, Para fine	per lb.	3/1½	..
i	Iron Pig (Cleveland warrants) ..	per ton	48/5	dec.
l	,, Wire, galv. No. 8, P.O.qual.	per ton	£15	5d. inc.
g	Lead, English Ingot	per ton	£15 5 to £15 10	..
g	,, ,, Sheet	per ton	£15 9 to £16 14	10/- inc.
m	Manganin Wire No. 28	per lb.	8/-	10/- inc.
g	Mercury	per bot.	£8 5	..
d	Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d	,, ,, ,, medium	per lb.	2/6 to 4/-	..
d	,, ,, ,, large ..	per lb.	4/6 to 6/6	..
p	Phosphor Bronze, plain castings	per lb.	1/1 to 1/2	..
p	,, rolled bars & rods	per lb.	1/2 to 1/8	..
p	,, ,, strip & sheet	per lb.	1/2½ to 1/5	..
o	Platinum	per oz.	110/-	..
e	Silicium Bronze Wire	per lb.	10d.	..
r	Steel, Magnet, in bars		£60	..
g	Tin, Block (English)	per ton	£131 to £132	£5 inc.
n	,, Wire, Nos. 1 to 16	per lb.	1/9½	..
p	White Anti-friction Metals— "White Ant" brand	per ton	£40 to £60	..
k	Zinc, Sh't (Vieille Montagne bnd.)	per ton	£25	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Dublin United Tramways Co. (1896), Ltd.—The report for the half-year ended December 31st states that £64,840 is available for division. Dividends for the half-year at the rate of 6 per cent. per annum, free of income-tax, on the ordinary shares, together with a bonus of 1s. per share, also free of income-tax, on the ordinary shares, are recommended; £5,000 is placed to reserve and renewals fund, £1,000 to accident insurance fund, £10,000 towards reconstruction and maintenance, and £2,000 as further provision against the guarantee to the Irish International Exhibition (1907), in addition to the £6,250 already paid in respect of this guarantee and charged to revenue in these accounts; £8,740 is to be carried forward.

City of Buenos Ayres Tramways Co., Ltd.—For the year ended December 31st a balance dividend of 1s. 3d. per share is recommended, £3,600 being transferred to the general amortisation fund, and £144 carried forward.

STOCKS AND SHARES.

Tuesday Evening.

Monetary conditions remaining tranquil, the stock markets are featured this week by a further series of improvements in the prices of investment securities. Consols led a sharp rise on Monday last, and the inclination amongst buyers is to seek the best-class issues. Consequently, prior-charge stocks are the subject of brisk demand. Preference and Ordinary shares, however, have by no means lagged behind. It may be said that the buying shows a healthy tendency to broaden—a tendency backed by the hope of another fall in the Bank Rate taking place before long.

This week's new issue of most interest to those who especially follow electrical work is the £460,000 4½ per cent. Debentures offered at 96 by the Montreal Street Railway Co. The Debentures are attractive in several respects.

Electricity supply stocks and shares have halted, for the time being, on their improving path. The Westminster Electric Corporation disappointed some of its supporters by the declaration of a 5s. dividend, making 10 per cent. for the year, as against the previously paid 12 per cent. This caused Westminster Ordinary to drop 10s. Charing Cross Ordinary are a little lower after their recent swift advance. County of London issues are better; all four show gains, and City of London second Debenture rose a point. An equal rise took place in Midland Electric 4½ per cent. Debenture stock. Notting Hill shares, somewhat overlooked in the latest outburst of buoyancy, put on 5s., and several provincial shares have come into request locally. Folkestones and Oxfords are each better on this account.

Domestic railway stocks have been very despondent, and only within the last day or two was there any attempt to invigorate prices. City and South London has fallen 3, and Central London Deferred a point. Both stocks still carry the dividends. Metropolitan Consolidated at 38 is *ex.* the 5s. per cent. distribution, while Districts at 10½, to quote the bitter humour of a proprietor, are *cum.* dividend. Great Northern, Piccadilly and Brompton £10 Ordinary shares, fully paid, stand at 4—5, and business is being done in the 4 per cent. Debenture stock on the basis of 84—85. The Charing Cross and Hampstead 4 per cent. Debenture is some nine points lower than the Piccadilly stock.

The terrible tragedy in Portugal has not, of course, affected the Debenture stock of Anglo-Portuguese Telephone Co., although naturally it depressed Portuguese Government bonds. Telephone stocks are firm throughout, and the announcement of a 6 per cent. dividend on National Telephone Deferred, with very substantial appropriations to reserve and carry-forward, must excite satisfaction in the minds of holders. The stocks enjoyed their rise in advance of the declaration, so the Third Preference shares and the 4 per cent. Debenture stock are the only issues with quotable changes this week.

Telegraph stocks are good, and the chief features are rises of £3 in Great Northerns and £1 in Indo-Europeans. West India and Panama pursue their upward course, West Coast of America have rallied again, and Eastern Extension shares gained a fraction. In the American group, Anglo Preferred picked up ½, though the Deferred dropped ½, and further buying orders from the United States, brought about a 4 points rise in Commercial Cable 4 per cent. Debenture stock.

Globe Telegraphs of both kinds are raised. Submarine Cables Trust certificates are a point to the good.

Tramway descriptions continue an improving market. Anglo-Argentine Second Preferences show a ⅛ gain, and the First Preferences at 6½ added the fraction. British Columbia stocks have been decidedly strong, Calcutta Trams are better, and British Electric Tractions found a few buyers. On the other hand, London United Preference and Dublin United Ordinary are 5s. lower.

Better demand for industrials has brought several electrical issues to the front. Callender's Preference hardened, and so did Henley's Debenture. British Insulated shares and Debenture have been advanced, but Westinghouse Debenture at 42½ is nominally 2½ lower. Brush Preference have rallied from their last week's fall.

Advance copies are in circulation of the Caribbean Anglo-Columbia Cable Co.'s issue, which will be offered to the public very shortly.

Metropolitan District Railway Co.—The directors have declared a dividend on the 4 per cent. guaranteed stock for the past half-year, at the rate of 1⅞ per cent. per annum. A year ago the rate was 1½ per cent. per annum.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Jan. 28th.	Closing Quotations Feb. 4th.	Business done week ended Feb. 4th, 1908. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2 — 3	2 — 3	..	..	..	Nil
143,800	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 14 11
$181,551,400	American Telephone & Telegraph, Cap. Stock	$100	7½%	7½%	8 %	..	110 —113	109 —113	..	..	— ½	7 1 7
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	..	86 — 88	86 — 88	..	..	..	4 10 11
622,600	Anglo-American Telegraph	Stock	2¾%	3½%	3½%	3½%	57 — 60	57 — 60	57⅞	57½	..	5 16 8
3,188,700	Do. do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	101 —103	101½—103½	102¾	100	+ ½	5 15 11
3,188,700	Do. do. do. Deferred	Stock	Nil	½%	1¾%	1 %	16½ — 17	16½ — 16¾	16 5/16	16⅛	— ¼	5 15 9
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	..	99 —102	99 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	6¾ — 7½	6¾ — 7½	7⅛	..	..	5 10 4
2,300,459	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	..	82 — 85	86 — 89	87½	84	+ 1	4 9 11
16,000	Cuba Telegraph	10	5 %	5 %	5 %	..	6½ — 7⅛	6½ — 7⅛	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	15⅞ — 16½	15⅞ — 16½	..	..	..	5 19 5
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3½ — 3⅝	3½ — 3⅝	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	..	8¾ — 9½	8¾ — 9½	..	..	..	5 5 8
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	..	98 —101	99 —102	..	..	+ 1	8 16 6
60,710	Direct United States Cable	20	3½%	4½%	4½%	..	13¾ — 14½	13⅞ — 14½	14	13¾	..	6 10 9
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	..	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	130 —135	130 —135	133	130	..	5 3 8
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	..	82 — 85	84 — 87	86	82½	+ 2	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red.	Stock	4 %	4 %	4 %	..	99 —102	100 —103	102½	101	+ 1	3 17 8
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	12¾ — 12⅞	12¾ — 13	12 15/16	12½	+ ⅛	5 7 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —104	99 —102 xd	..	..	—2	3 18 5
286,800	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	99 —102	97 —100 xd	..	..	..	4 0 0
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	99 —101	99 —101	..	..	..	15 17 0
181,127	Globe Telegraph and Trust	10	5⅜%	5½%	5½%	..	9⅝ — 10⅜	10 — 10½	10 5/16	10	+ ⅛	5 4 9
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	13½ — 13⅞	13⅝ — 14	13⅞	13 5/16	+ ¼	4 6 9
150,000	Great Northern Telegraph, of Copenhagen	10	24 %	24%	20 %	..	30 — 32	33 — 35	32½	31½	+3	5 14 3
86,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	..	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	52 — 55	53 — 56	..	..	+1	6 13 11
$41,880,400	Mackay Companies Common	$100	1 %	2 %	3⅜%	..	58 — 64	58 — 63	..	..	..	5 11 1
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	..	61 — 67	61 — 67	..	..	..	5 19 5
384,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	1/16 — 1/8	3/16 — 1/4	15/-	..	+ 1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	..	1/16 — 1/16	1/16 — 1/16	20/7½	..	..	4 14 1
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	..	1 — 1	1 — 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	111 —113	111 —113	112	111	..	5 6 2
3,341,425	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	110 —112	110 —112	111½	110½	..	4 7 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	11 — 13	11 — 13	..	..	..	4 12 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10½ — 12½	10½ — 12½	..	..	..	4 0 0
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 1/16 — 5 1/16	5⅛ — 5⅛	5 1/32	5⅛	+ 1/16	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	3½%	97 — 99	97 — 99	97⅝	97¼	..	3 11 1
1,710,093	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99½—101¼	100¼	100	+ ⅛	3 18 10
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6½%	7 %	7 %	..	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	5 17 11
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	..	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	5 1 1
99,100	Do. do. do. 4 % Red. Deb. Stock	100	..	4 %	4 %	..	90 — 93	90 — 93	..	..	..	4 6 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	..	98 —101	98 —101	..	..	..	3 19 3
11,839	Reuter's	8	5 %	5 %	5 %	..	7 — 8	7 — 8	7⅛	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
8,167	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	125 —128	126 —129	..	..	+1	5 0 8
100,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6½ — 7	6½ — 7	..	..	..	6 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	4½ — 5½	4½ — 5½	..	..	..	4 15 3
15,609‡	West African Telegraph, Shares	10	4½%	4 %	4 %	..	10 — 10⅜	10 — 10⅜	..	..	..	4 16 2
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2	Nil	Nil	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	37/6	35/7½	+ ⅛	10 13 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	98 — 101	98 —101	..	..	..	3 19 3
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	7 %	..	12¾ — 13⅜	12¾ — 13⅜	13⅛	12⅜	..	5 4 8
800,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	98 —101	98 —101	99¼	..	..	3 19 3
86,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	3/32 — 5/32	5/32 — 7/32	12/-	8/9	+ 3/32	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	..	7⅞ — 8	7⅞ — 8¼	..	..	+ ⅛	9 13 11
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	7⅞ — 8	7⅞ — 8¼	7⅛	..	+ ⅛	Nil
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	..	100 —103	98 —101	..	..	—2	4 19 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	8 %	..	7⅞ — 8¼	8 1/16 — 8 5/16	8⅛	8	+ 1/16	4 16 3
260,007	Do. 6 % Cum. Prefs., 1 to 260,007	5	5½%	5½%	5½%	..	5¾ — 6⅛	6 — 6¼	6 3/32	6 1/16	+ ⅛	4 8 0
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	..	126 —131	126 —131	..	..	..	4 11 7
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock	100	5 %	5 %	5 %	..	102 —105	102 —105	..	..	..	4 15 3
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	30 %	..	3¼ — 3⅜	3¼ — 3⅜	75/-	71/3	..	5 6 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	6 %	6 %	6 %	..	1⅛ — 1⅛	1 1/16 — 1 1/16	..	..	..	3 16 10
40,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	..	3¾ — 4¼	3⅞ — 4¼	85/-	78/9	..	7 15 7
40,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	4⅜ — 5⅛	4⅜ — 5⅛	98/9	..	+ ⅛	6 13 4
20,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	5 11 8
20,000	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	..	3½ — 4¼	3½ — 4¼	..	..	..	4 14 1
20,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	100 —103	100 —103	..	..	..	5 13 5
238,320	Do. do. 5½ % Loch Leven Debs.	100	..	..	5½%	5½%	98 —101	96 — 99 xd	99⅜	..	—2	5 11 1
800,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	..	125 —128	127 —130	15/7½	..	+2	4 12 4
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	..	105 —109	106 —110	106½	103½	+1	4 10 11
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	..	100 —104	103 —106	103⅜	103⅛	+2½	4 14 4
800,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	..	100 —103	100 —103	102½	..	..	4 7 3
235,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
220,000	British Electric Traction	10	6 %	3 %	Nil	..	1⅛ — 1⅜	1⅛ — 1⅜	28/9	..	..	Nil
133,301	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	4½ — 4¾	4⅝ — 5⅛	96/3	81/3	+ ⅜	11 14 2
161,437	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	..	90 — 95	93 — 97	96	95½	+2	5 3 1
1,448,653	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	68 — 73	70 — 74	69½	..	+1	6 1 7
410,178	British Insulated and Helsby Cables	5	8 %	8 %	10 %	..	6½ — 7	6⅝ — 7⅛	..	..	+ ⅛	7 0 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅝ — 6⅛	6 1/16 xd	6	5½	— ⅛	5 0 0
100,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102½	..	..	4 7 5
500,000	Do. do. 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	..	85 — 89	85 — 89	..	..	..	4 18 11
212,000	British Thomson-Houston 4½ % 1st Mort. Debs.											
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	⅝ — 1	⅝ — 1	..	..	..	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	..	40 — 50	40 — 45	41	..	..	8 17 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	2½%	Nil	..	0 — ⅜	0 — ⅜	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	..	⅜ — ⅝	¼ — ⅝	..	..	—1	5 5 11
125,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	..	83 — 86	82 — 85	..	..	..	6 16 4
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	..	63 — 66	63 — 66	..	..	..	3 1 6
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	4 %	3 %	3 %	..	4⅜ — 4¾	4⅜ — 4⅞	23/9	..	..	5 14 3
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	..	4¾ — 5¼	4¾ — 5¼	..	..	..	5 14 3
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	..	4¼ — 5¼	4¼ — 5¼	..	..	..	4 6 2
310,000	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	..	110 —116	110 —116	..	..	..	4 15 3
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	..	102 —105	102 —105	..	..	..	5 10 4
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	8 %	..	6½ — 7	6⅞ — 7⅛	7	7	+ ⅛	4 13 0
80,000	Do. 5 % Cum. Pref., Nos. 1 to 29,890	5	..	5 %	5 %	..	4⅝ — 5⅛	4¾ — 5⅛	..	..	..	4 5 9
860,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	..	101 —105	101 —105	..	..	..	6 6 4
85,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	..	9¼ — 10⅜	9⅞ — 10½	10⅛	..	+ ⅛	4 6 11
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5¼ — 5⅝	5¼ — 5⅝	..	..	..	4 4 1
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	..	104 —106	103 —107	..	..	+1	Nil
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	..	1/32 — 1/16	1/32 — 1/16	..	..	..	5 16 4
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	..	1⅛ — 1⅜	1⅛ — 1⅜	25/9	..	—1	4 7 5
215,045	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	100 —103 xd	..	..	..	4 8 3
1,893,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	8 %	65 — 68	65 — 68	67⅛	66	..	4 13 0
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	85½	..	..	4 5 1
553,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	44 — 47	43 — 46	..	..	..	5 1 2
1,480,000	City and South London Railway	Stock	2½%	1½%	2½%	2½%	41 — 46	40 — 42	44	41	—4	

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Jan. 28th.	Closing Quotations Feb. 4th.	Business done week ended Feb. 4th, 1908.		Rise + or Fall —	Present Yield per cent.
		*	1904.	1905.	1906.	1907.			Highest	Lowest.		£ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	2½%	5 %	..	1⅝— 2	1⅝— 2	38/1½	36/10½	..	7 10 11
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	..	93 — 96	92 — 95	93	92½	—1	5 5 8
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	..	1 — 1⅛	1 — 1⅛	..	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1 — 1⅛	1 — 1⅛	..	..	..	4 16 0
282,580	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6½%	13 — 14	12½— 13½	..	..	— ½	4 8 9
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	13⅜ — 13⅝	12⅝— 13⅝	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	4½%	4½%	..	1⅛ — 1¼	1⅛ — 1¼	18/1½	..	..	11 7 6
17,139	Do. "A" shares, 01—017,139	5	2½%	4½%	4½%	..	1¼ — 2⅛	1¼ — 2⅛	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	78 — 81	78 — 81	..	..	..	4 18 9
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	87 — 90	87 — 90	..	..	..	5 11 1
112,100	Electric Contruction, 1 to 112,100	2	Nil	Nil	Nil	..	⅝ — 1	⅝ — 1	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	Nil	..	1⅛— 1¼	1⅛— 1¼	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7⅞— 8¼	7⅞— 8¼	..	..	..	6 1 3
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	..	89 — 92	89 — 92	..	..	..	4 19 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	..	1¼— 1⅜	1¼— 1⅜	..	..	..	17 15 6
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½— 10⅝	10½— 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103	102 —103	..	..	..	4 17 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	..	10½— 11½	10½— 11½	11⅛	10⅜	..	6 10 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	4⅝— 5⅛	4⅝— 5⅛	..	..	..	3 19 1
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	104½—106½	105 —107	..	..	+ ½	4 4 1
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	5 %	10%	10 %	..	14½— 15½	14⅜— 15½	..	..	..	6 9 0
37,500	‡Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	⅜%	1⅛ — 1⅜	1⅛ — 1⅜	..	..	+ ⅛	Nil
10,000	‡ Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	8 — 8½	7⅞ — 8	..	..	— ⅛	6 5 0
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	8 %	8 %	..	6⅛ — 6⅝	6⅛ — 6⅝	..	..	..	4 8 11
399,930	Do. do. 60,008 to 100,000	10	6 %	8 %	8 %	..	6⅛ — 6⅝	6⅛ — 6⅝	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	..	7⅛ — 8⅛	7⅛ — 8	7⅛	..	..	5 17 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	..	81 — 85	81 — 85	..	..	..	4 14 2
5,732,062	Metropolitan Consolidated	100	3 %	2½%	1 %	½%	..	..	39	37½	..	..
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	..	..	..	64½	64⅜	..	..
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	..	..	..	..	..	..
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	..	1/16— 3/16	1/16— 3/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	13/16— 15/16	13/16— 15/16	18/-	..	..	5 6 8
350,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	..	93 — 96	94 — 97	94	..	+1	4 12 9
245,500	Potteries E. Trc.	1	5 %	4 %	4 %	..	1/16— 1/8	1/16— 1/8	..	..	— 1/16	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	3/16— 1/4	3/16— 1/4	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	93 — 96	93 — 96	..	..	..	4 13 9
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	..	29 — 31	29 — 31	29½	..	..	5 5 6
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	..	100 —103	100 —103	101½	..	..	3 17 8
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	5 %	5 %	5 %	..	36 — 40	36 — 40	..	..	..	12 10 0
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	Nil	5 %§	1 — 1⅛	1 — 1⅛	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	Nil	Nil	..	6 %§	3¼ — 3⅜	3¼ — 3⅜	..	..	..	..
246,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	72 — 77	72 — 77	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

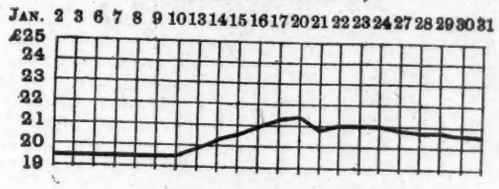
15,000	Bromley (Kent) E.L. & P,. 1 to 15,000	5	5½%	5½%	5½%	..	4⅝— 5⅛	4⅝— 5⅛	..	..	..	5 7 4
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	..	95 — 98	95 — 98	..	..	..	4 11 10
30,131	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	..	7 — 8	7 — 8	7½	..	..	6 5 0
9,869	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	7 — 8	7 — 8	..	..	..	4 7 6
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	..	97 —100	97 — 100	..	..	..	4 0 0
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	..	4½— 5	4⅜— 4⅝	..	..	— ⅛	5 5 3
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	4½— 5	4⅜— 5	95/-	..	..	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	..	4⅛— 4⅜	4⅛— 4⅜	..	..	..	4 14 9
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	97 —100	97 —100	..	..	..	4 0 0
49,486	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	..	3⅝— 4⅛	3⅝— 4⅛	..	..	..	5 5 11
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	..	101 —104	101 —104	103⅜	..	..	4 6 7
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	..	10 — 11	10 — 11	10½	10¼	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	11¼ — 12½	11¼ — 12½	..	..	..	4 16 0
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	..	120 —123	120 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	..	97 —100	98 —101	100½	100	+1	4 9 1
40,000	County of Durham Electrical Power, Ord.	5	£3 7 0	4 %	4 %	..	3½— 4¼	3½— 4¼	..	..	..	4 14 1
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	..	4⅜— 4⅝	4⅜— 4⅝	..	..	..	5 2 7
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	..	6¼— 7⅛	7 — 7⅞	..	..	+ ⅜	6 9 0
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10⅞— 11¼	11 — 11⅝	11⅜	11 5/16	+ ⅛	5 4 4
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	..	103 —106	105 —108	106	..	+2	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	..	95 — 98	96 — 99	..	..	+1	4 10 11
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4 %	Nil	..	⅜— ⅞	⅜— ⅞	..	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	..	¾— 1⅛	¾— 1⅛	25/-	..	..	10 0 0
433,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	70 — 80	70 — 80	..	..	..	5 12 6
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4½— 5	5 — 5½	..	..	+ ⅛	5 7 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	..	5 — 5½	5 — 5½	..	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	..	94 — 97	94 — 97	..	..	..	4 12 9
15,000	Hove, 1 to 18,000	5	8½%	9 %	9 %	..	6¼— 6⅝	6¼— 6⅝	6⅝	..	..	6 13 4
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	..	8 — 9	8 — 9	..	..	..	5 11 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	96 — 99	95 — 98	..	..	—1	4 1 8
10,000	London Electric Supply Corporation, Limited, Ord.	3	3 %	4 %	4 %	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	6 16 2
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4⅝— 5⅛	4⅝— 5⅛	97/6	..	..	6 3 1
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4½%	..	90 — 94	91 — 93	..	..	+1	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	..	6 — 6½	6 — 6½	6⅝	..	..	6 4 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	..	4⅞— 5⅛	4⅞— 5⅛	5 1/16	..	..	4 3 9
220,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	..	102 —106	102 —106	..	..	..	4 4 11
250,000‡	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	..	85 — 90	85 — 90	85	..	..	3 17 9
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	96 — 99	97 —100	..	..	+1	4 10 0
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	..	6⅛ — 6⅝	6⅛ — 6⅝	..	..	..	5 18 6
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	..	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	..	11¼ — 12½	11¼ — 12½	..	..	+ ½	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	5⅝— 6	5⅝— 6⅛	5⅝	..	+ ⅛	5 14 3
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	..	93 — 95	93 — 95	..	..	..	4 4 3
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7⅜— 8⅜	7⅜— 8⅜	8⅛	..	..	5 14 3
20,000	Do. do. 7 % Pref. 20,061 to 40,080	5	7 %	7 %	7 %	7 %	6⅞— 7⅛	6⅞— 7⅛	..	..	— 1/16	4 16 7
150,000‡	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	85 — 90	85 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	..	¾— 1⅛	¾— 1⅛	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	71 — 75	70 — 74	..	..	—1	5 8 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	..	2½— 3	2½— 3	..	..	..	5 0 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	..	⅝— ¾	⅝— ¾	..	..	..	3 6 8
117,988	Do. do. 7 % Pref.	1	7 %	7 %	7 %	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	3 14 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	101 —104	101 —104	..	..	..	4 6 7
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	1⅞— 2⅛	1⅞— 2⅛	..	..	..	12 10 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2⅛	2 — 2⅛	42/6	..	..	10 0 0
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	..	90 — 93	90 — 93	..	..	..	4 16 9
110,000	Westminster Electric Supply, Ord.	5	14 %	12 %	12 %	10 %	8⅛ — 9⅛	8 — 9	8⅛	8	— ⅛	5 11 1
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	4½%	4½%	5 — 5⅛	5 — 5⅛	5 1/16	5⅛	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

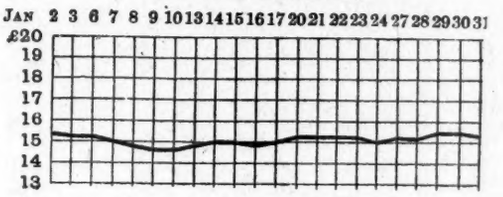
METAL MARKET.

Fluctuations in January.

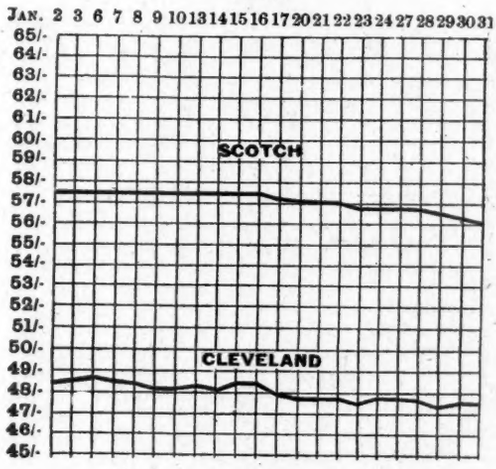
SPELTER (G.O.B's.).



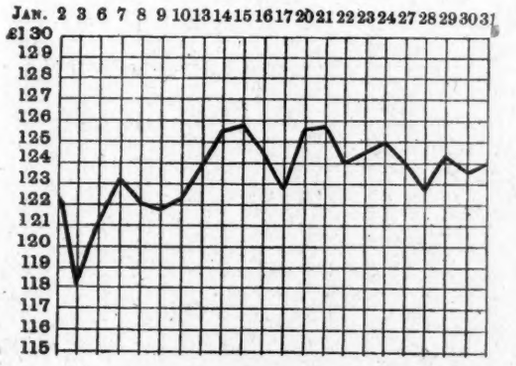
LEAD (ENGLISH).



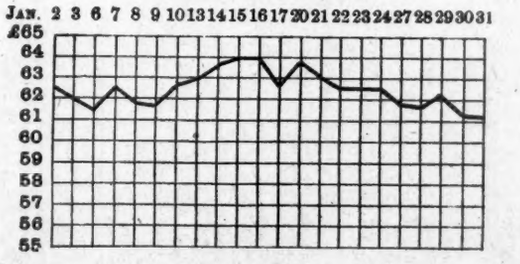
IRON.



TIN.



COPPER (G.M.B's.).



Swedish Telephones.—The Government has introduced a Bill into the Riksdag providing for a loan of £278,000 for the development of the telephonic service in Sweden.

TRADE STATISTICS OF BRAZIL IN 1906.

The following statement showing the imports of electrical and other goods into Brazil during the year 1906 is taken from the recently issued trade statistics; the figures for 1905 have been added for purposes of comparison, and a statement of increases and decreases is also given :—

	1905. Milreis.	1906. Milreis.	Increase or decrease. Milreis.
Copper Wire, plain or covered with Paper, Cotton, Silk, &c.—			
From Germany	326,690	666,466	+ 339,776
„ France	36,092	30,839	− 5,253
„ Great Britain ...	146,698	166,230	+ 19,532
„ United States ...	356,558	973,147	+ 616,589
„ Other countries ...	23,915	28,405	+ 4,490
Total	889,953	1,865,087	+ 975,134
Iron or Steel Wire—			
From Germany ...	1,953,593	2,257,224	+ 303,631
„ Great Britain ...	302,078	317,102	+ 15,024
„ United States ...	1,015,621	832,405	− 183,216
„ Other countries ...	105,921	124,200	+ 18,279
Total	3,377,213	3,530,931	+ 153,718
Rails and Accessories—			
From Germany	496,770	3,539,566	+3,042,796
„ Great Britain ...	2,111,603	1,862,059	− 249,544
„ United States ...	413,935	2,116,038	+1,702,103
„ Belgium	5,100,383	3,149,553	−1,950,830
„ Other countries ...	232,976	82,790	− 150,186
Total	8,355,667	10,750,006	+2,394,339
Insulators—			
From Great Britain ...	6,856	28,815	+ 21,959
„ United States ...	25,830	139,518	+ 113,688
„ Germany	31,106	70,830	+ 39,724
„ Other countries ...	7,993	16,192	+ 8,199
Total	71,785	255,355	+ 183,570
Apparatus for Electricity, Electric Lighting, &c.—			
From Germany	902,292	1,166,545	+ 264,253
„ France	258,083	150,109	− 107,974
„ Great Britain ...	741,429	461,691	− 279,738
„ United States ...	1,798,529	2,386,120	+ 587,591
„ Italy	13,964	11,567	− 2,397
„ Switzerland ...	24,155	128,745	+ 104,590
„ Other countries ...	34,406	40,046	+ 5,640
Total	3,772,858	4,344,823	+ 571,965
Industrial Machinery—			
From Germany	525,467	608,679	+ 83,212
„ France	243,116	286,972	+ 43,856
„ Great Britain ...	3,143,625	3,173,328	+ 29,703
„ United States ...	832,743	261,840	− 570,903
„ Other countries ...	109,341	66,049	− 43,292
Total	4,854,292	4,396,868	− 457,424
Other Machinery, except Sewing, Agricultural, Printing, &c.—			
From Germany ...	2,124,942	1,757,938	− 367,004
„ France	1,085,038	853,295	− 231,743
„ Great Britain ...	5,538,924	3,535,472	−2,003,452
„ United States ...	2,310,683	2,174,808	− 135,875
„ Other countries ...	612,608	406,337	− 206,271
Total	11,672,195	8,727,850	−2,944,345
Scientific Instruments, except Surgical and Optical—			
From Germany	121,626	128,196	+ 6,570
„ France	146,848	129,846	− 17,002
„ Great Britain ...	113,485	80,222	− 33,263
„ United States ...	109,755	69,495	− 40,258
„ Other countries ...	27,093	31,820	+ 4,727
Total	518,805	439,579	− 79,226
Boilers, &c.—			
From Germany	115,969	179,037	+ 63,068
„ Great Britain ...	614,690	745,433	+ 130,743
„ United States ...	193,679	136,984	− 56,695
„ Other countries ...	111,550	141,531	+ 29,981
Total	1,035,888	1,202,985	+ 167,097

N.B.—Milreis about 1s. 3¼d.

ELECTRIC LIGHT AND POWER STATIONS IN THE FAR EAST.

WE are indebted to the Engineering Society of Siam for a table from which we reproduce the following particulars of electric light and power stations in the Far East. It may also be of interest to refer our readers to the "Electricity Works" pages in the Colonial and General section of the *Universal Electrical Directory* for particulars of many other such stations and systems abroad. The following statistics would form a useful companion to the information there given.

Town or district.	Name of authority.	Population.	Date open.	Current.	System of generation and distribution.	Voltage at		Connections.			No. of consumers.	Boilers.	Engines.	Dynamos.	Transformers or batteries.	Meters.	Fuel.		Selling price per unit.			Plant capac. in KW.	Remarks.
						Power station.	Consumers' terminals.	Lamps, 8 C.P.	Arc lamps, 10 amp. or equiv.	Motors, total horse-power.							Class.	Price per ton.	Lighting.	Power.	Street lighting.		
1. Aomori, Japan	Aomori Electric Lighting Co.	38,000	1899	A.C. 60 ~	Gen. by 3-ph. 3-wire and distributed by 1-phase	G.S.* 6,600 S.S., 2,000	100	5,400	9	—	519	—	425-H.P. Pelton water-wheel, 600 rev.	G.E. Co. 600 rev.	Trsf., G.E. Co.	G.E. Co.	—	—	16 C.P. 1.30 yen per month.	—	15 Sen	200	* G.S., generating station; S.S., sub-st'n. Effective head 390 ft. 800 cb. ft. per minute.
2. Batavia, Java	Nederl: Indische Electriciteit Maasschappy (Dutch)	9 000 Eurpn. 30,000 Chin. 77,700 Yav.	1897	A.C. 50 ~	1-phase 2-wire	2,000	110	17,300	122	—	500	Stein-mullers	Vert. Comp.	—	—	S. & H. Helios Aron A. E. G.	Liquid	£1 8s. 4d. per 1,000 Liter	40 cts.	—	—	560	Reduction for large consumers.
3. Bandoeng, Yava	Bandoeng's che Electriciteits Maasschappy (Dutch)	28,900	1906	A.C. 100 ~	3-phase	6,000	220, 110	10,000	—	100	—	—	Pelton Water Wheels	—	—	—	—	—	—	—	—	750	
4. Bangkok, Siam	The Siam Electricity Co., Ltd. (Danish)	500,000	1890	A.C. 100 ~ and D.C.	Overhead 1-phase 2-wire H.T. 2 and 3 wires L.T.	2,050 A.C. 550 D.C.	100	67,000	70	1,500 400 fans	600*	B. & W.	Brush Compound B. & W. triple: Curtis-Turbine (500 KW.) and others	A. C. Mordey S. & H. G.E. Co. D. C. Shorts Westinghouse G.E. Co. S. & H.	Trsf: Brush Victoria S. & H. G.E. Co. Packard	Ferraries Thomson, G.E. Co. S. & S.	Paddy Husk Liquid	£2	Govnm. 16 atts. prv. 32 atts.	24 atts.	16 atts.	2,500	11 miles single track started 1893, *) not including the King's Palaces, Govmnt. buildings and street lighting, principle streets lighted with 1,700 incandescents.
5. Cebu, Philippines	Visoyas Electric Co. (American)	45,000	—	A.C. 60 ~	2-phase	220	220	4,500	24	—	—	Scotch Marine	Corliss	Bullock	—	Sangamo & Westinghouse	Coal	$6	—	—	—	115	
6. Bombay, India	Bombay Tramway and Electric Lighting Co. (British)	c. 1,000,000	1905	A.C. 50 ~ and D.C.	3-phase and D.C. 3 wires	5,500	230	18,258 incl. arcs.	—	7,496 389 fans	149	B. & W.	Brush Comp. Turbo	Brush Alt.	—	Ch. & Hook.	Indian Coal	—	8.50—3.50* Annas	3.50—1.50* Annas	—	800	* Wright system.
7. Calcutta, India	Calcutta Electric Supply Co., Ltd. (British)	949,144	1899	D.C.	3 wires	460	225	122,000*	—	c. 500	1,387*	B. & W.	Belliss	Crompton	—	,,	Bengal Coal	Rs. 7	7 Annas †	4 Annas †	—	3,800	* 1903. † Less rebate.
8. Colombo, India	The Colombo Electric Tramway & Lighting Co. (British)	155,000	1895	A.C. 60 ~ and D.C.	A.C., 2 wires D.C., 3 wires	2,000 A.C. 440 D.C.	100	21,500	50	50	211	B. & W.	Diff.	G.E. Co., U.S.A.	—	,,	Coal	Rs. 12 to 13.50	10 cts	—	22 cts. per lamp per hour of 10 amp., arcs	1,750	Tramway started in 1898, double track 6½ miles, 550 volts, 36 cars
9. Fukuoka, Japan	Hakata Electric Lighting Co.	71,365*	1897	A.C. 133 ~	1-phase 2 wires	2,120	100	7,860	4	—	1,425	W. T.	Compound	Hopkinson	—	Thomson	Coal	Yen 5.2	Yen 1.30 † 1.75 ‡	—	Yen 1.70 ‡	360	* December, 1905 † pr. 16 C.P. (h.n.) per month ‡ pr. 16 C.P. (a.n.) per month
10. George Town, Penang	Municipal Commissioners (British)	100,000	1904	D.C.	3 wires underground, solid	480 to 550	460 and 497	10,000	47	1	188	B. & W.	Diff.	—	—	B.T.-H. and Cham. & Hookham	Wood	$2.14½	30 cts	—	15 cts	650	
11. Honoi, Tonkin	S'Indo-Chinese d'Electricité (French)	—	1895	D.C.	3 wires	240	240	—	—	—	—	—	Corliss and pibous(?) comp.	Farcot	—	Hart. and Braun	Hongay coal	$10	Fr. 0.80 *	Fr. 0.35	Fr. 0 40 0.36	840	* Maximal
12. Honoi, Tonkin	S'Fonciered l'Indo-Chine (French)	100,000	1900	D.C.	Overhead and rails return	550	500	—	—	—	—	—	Sautter Harlé	—	—	—	Hongay coal	—	—	Fr. 0.12	—	420	
13. Haypong ..	Société Indo-Chinoise d'Electricité	1,000 Eurpn. 18,000 Ntv.	1894	D.C.	3 wires	255	250 240	2,500	30	—	250	—	Marshall Corliss Farcot	Edison Gramme Farcot	—	—	—	Fr.21	Fr. 0.76	—	Fr. 0.60	450	
14. Hiroshima and Kure, Japan	Hiroshima Water Power Electric Co.	130,000 100,000	1899	A.C. 60 ~	3-phase	1,150*	200 100	18,740	15	221	780	—	† Pelton Wheel G.E. Co., U.S.A.	G.E. Co., U.S.A.	—	—	Water	—	Sen 8	Sen 7	—	750	* Transmiss. 10,000 v. Sub-station 2,200 v. † 400 H.P., 270-ft. head. 3,000 cb. ft. per min.
15. Kandy ..	Colombo Gas and Water Co., Ltd.	30,000	1900	D.C.	3 wires	400	200	4,642	25	113	65	B. & W.	Belliss	Parker	Parker	Electrolytic	Coal	Rs. 20	50 cts. 40 ,,	40 cts. 25 ,,	45 cts.	154	
16. Kanazawa, Japan	Kanazawa Electric Co.	104,935	1900	A.C. 60 ~	3-phase	2,500	100	10,642	—	77	2,326	—	Pelton Wheel, Westinghouse Comp.	Westinghouse	Westinghouse G.E. Co.	Westinghouse Thomson	Water	—	Yen 0.05	Yen 0.02	Yen 0.045	480	Transmiss. line 5 miles Water course 35 ,,
17. Kobe, Japan	Kobe Electric Light Co.	326,000	1888	A.C. 60 ~	Gen., 2-phase Distb., 1 ,,	1,000	100	31,868	41	—	3,309	W.-T.		—			Coal	Yen 10*	Sen 24	* Sldg. scale from 19 to 14 yen per H	Sen 24	1,260	* Monthly charges

Town or district.	Name of authority.	Population.	Date open.	Current.	System of generation and distribution.	Voltage at		Connections.			No. of consumers.	Boilers.	Engines.	Dynamos.	Transformers or batteries.	Meters.	Fuel.		Selling price per unit.			Plant capac. in kw.	Remarks.
						Power station.	Consumers' terminals.	Lamps, 8 c.p.	Arc lamps, 10 amp. or equiv.	Motors, total horse-power.							Class.	Price per ton.	Lighting.	Power.	Street lighting.		
18. Koriyama, Japan	Koriyama Silk Spinning Co.	16,200	1899	A.C. 60 ~	3-phase 4-wires	11,000	110	1,200	3	340	320	—	Water-turb.	—	—	—	Water	—	Sen 10	Yen 25-60 per H.P. per yr.	Yen 0.95 per 16 c.p. per mth.	850	Transmission line 15 miles.
9. Kowloon, excluding Hong Kong	China Light and Power Co., Ltd.	77,750	1903	A.C. 60 ~	Overhead mains	2,000	100	—	—	—	—	W.-T.	Comp.	—	—	Westing-house	—	—	30 cts. 35 ,,	—	20 cts.	204	
Kyoto, Japan	Kyoto Suiriji-musho	381,940	1891	A.C., 133, 60 and 50 ~ and D.C.	Overhead, 3-phase, 2-phase, D.C.	3,500 2,100 500	500 230	18,920	26	1,523	78	—	—	—	Westn. Stanley G.E. Co. S. & H.	—	Water	—	Sen 2.08	Sen 2.08	Sen 8.8	1,500	
1. Kyoto, Japan	Kyoto Electric Light Co.	381,940	1889	A.C. 60 ~	1-phase, 3-phase	3,500 2,000	200 100	29,009	33	89	6,223	W.-T.	Comp.	—	Dare & Shell	Thomson	Screened coal	Yen 8·5	Sen 20	Yen 4.12 Pr. H.P. Pr. mth	Yen 1 Pr. 10 c.p. per month	930	Branches at Fukiu city 160 kw., Otsu city 80 kw., Nakatsu city 80 kw.
2. Manila, Philippines	Manila Electric Railway and Light Co.	220,000	1905	A.C. 60 ~ and D.C.	2-phase D.C.	3,300	224	75,000	310	400	2,550	W.-T.	Turb.	—	—	Westing-house	Aust. coal	—	$ 0.20	—	—	3,756	With boosters.
3. Medan, Java	Electriciteit Maatschappy "Medan"	766 Europe 6,357 Chinese 7,109 Natives	1899	A.C. 100 ~	1-phase overhead	1,050	110	7,040	24	300	142	—	Diesel	Westinghouse	Westgh., Mordey Trsf. Hagen Battery	Hookham, Schuckert	Iolar oil	f. 45	f. 0.30-0.37	—	f. 0.11	210	
24. Nagaoka Yechigo, Japan	Hokuyetsu Electric Power Co.	30,000	1905	A.C. 60 ~	3-phase, 3-wires	11,000	100	3,577	—	50	758	—	McCormick turb.	G.E. Co.	—	G.E. Co.	Water	—	Yen 0.075	Yen 0.025	Yen 0.06	540	
25. Nagano, Japan	Nagano Electric Light Co.	38,000	1897	A.C. 60 ~	3-phase	3,480	100	—	—	—	1,300	—	—	—	—	Edgewis (S. E. W.)	Water	—	Sen 7	—	—	490	
26. Nagasaki, Japan	Nagasaki Electric Light Co., Ltd.	163,324	1893	A.C. 125 ~	1-phase 2-wires	2,300	100	14,330	4	—	1,370	W.-T.	Diff.	Diff.	G.E. Co. Shibaura	—	Hizen coal	Yen 6	Yen 0.21	—	—	505	
27. Nagoya, Japan	Nagoya Electric Light Co., Ltd.	—	1888	A.C. 60 ~	2-phase 3 & 4 wires	2,300	200 100	27,107	42	440	—	B. & W.	McIntosh and Seymour, G.E. Co. Curtis turb	G.E. Co.	G.E. Co.	Thomson	—	Yen 10	Yen 0.24	Yen 12 per H.P p'r m'th	Yen 16.5 per lamp per month	1,100	
28. Osaka, Japan	Osaka Electric Light Co.	1,200,000	1889	A.C. 125 60 ~	1-phase 2 ,, 3 ,,	2,300 1,150	100 52	120,123	105	1,077	17,500	B. & W. Stirling	Comp. and Curtis turb.	G.E Co.	—	Thomson-Houston	Soft coal	Yen 8.40	Yen 0.24	Yen 16 per H.P. p'r m'th	Yen 1·32 (* per 20 c.p. per month	5,300	* Yen 17 per 6·8 amp. arc per month.
29. Sapporo, Hokkaido, Japan	Hokkai Lenki Co., Ltd.	55,000	1890	A.C. 60 ~ and D.C.	1-phase 2 & 3 wires	2,000 100	96 98	3,750	2	—	300	Tub'l'r	Non-condensing	Hopkinson Edison	—	Thomson	Fine bituminous	Yen 4.40	Yen 0.25	—	—	150	Are changing over to water-power 1,000 H.P. Stat Jozankei tr'nsmiss'n 16 miles 11,000 volts.
30. Sendai, Japan	Miyagi Boseki Dento Co., Ltd.	81,726	1894	A.C. 60 ~	Gen., 3-phase Distb., 1 ,,	2,300	100 110 220	8,632	—	218	834	—	Leffel turbines.	S. & H.	—	America and German.	Water	—	Yen 0.15	Yen 0.08	Yen 0.09	600	
31. Sverakarta, Java	Solo'sche Electricitteits My (Dutch).	100,000	1902	A.C. 100 ~	3-phase	3,000	110	10,000	20	—	300	B. & W.	Comp.	—	—	—	Wood	—	—	—	—	300	
Shanghai, China	Shanghai Municipal Council	12,000 Eup. 475,000 Ntv.	—	A.C. 50 ~	—	2,000	200 100	90,000	224	165	1,200	B. & W.	Ferranti and Brush	—	—	Westing-house	Japan dust coal	Tls. 6	14 Tlsee	7 Tlsee	175 Tls. per lamp per ann.	1,600	Motor generator for supplying 500 v.d.c. for lifts.
33. Tokyo, Japan	Tokyo Electric Light Co.	1,800,000	1885	A.C. 50 60 100 ~ and D.C.	1-phase 3-phase, D.C. 3 wires	2,200 3,300	200 100	172,725	144	728	15,424	W. T.	Triple engine and Parsons turbines.	—	E.P.S. Battery	Thomson	coal	Yen 5.10	Yen 0.30	Yen 0 18	Yen 1.20 pr. 10-c p. per mnth	4,000 6,000	Two power stations.
34. Victoria, Hong Kong	Hong Kong Elec. Co., Ltd.	232,100	1890	A.C. 75 ~ and D.C.	1-phase	2,000	200 100	38,000	85	20	—	Lanc. B. & W.	Belliss, Robey, and Browett	J. and P., G.E. Co., U.S.A.	D.P. and Chloride Batteries	Westing-house G.E. Co.	Japan coal	$10	35 cts.	—	$25 pr. Arc pr. mnth.	1,000	D.C. 200-volt for lifts.
5. Yokohama, Japan	Yokohama Union Electric Light Co., Ltd.	343,242	1890	A.C. 60 ~ and D.C.	1-phase 2-phase D.C.	2,400	100	50,475	14	11	4,281	W.-T.	McIntosh and Seymour Co. Curtis turbine.	—	Tudor Battery	Elihu Thomson	Coal	Yen 7.50	Yen 0.30	Yen 0.20	Yen 0.14	1,755	

1 £ sterling = 13.82 Ticals Siamese.
,, = 9.82 Yen Japanese.

1 £ sterling = 6.81 Tael Chinese.
,, = 9.82 Dollar Manila.

1 £ sterling = 8.55 Dollar Singapore.
,, = 14·88 Rupee India.

L. Diemer-Hansen, The Siam Electricity Co., Ltd., Bangkok, 1907.

PROCEEDINGS OF INSTITUTIONS.

The Conduit System of Electric Tramway Construction.

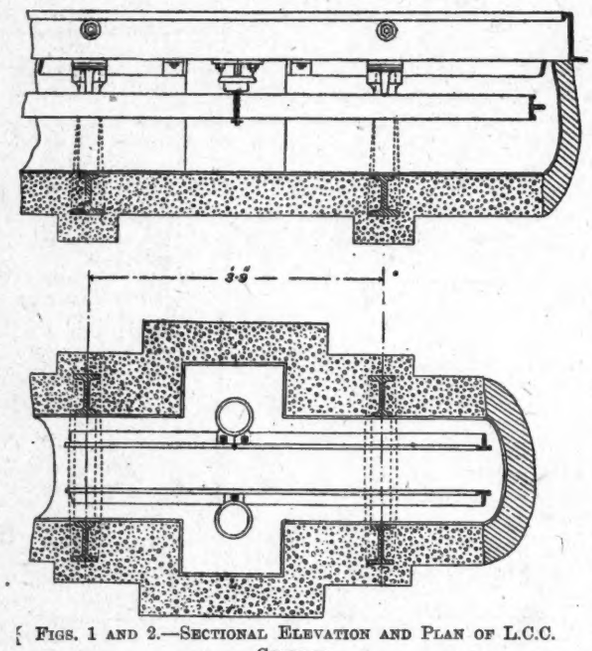
By Fitz Roy Roose, A.M.I.Mech.E.

(*Abstract of paper read before* The Junior Institution of Engineers, *January 8th*, 1908.)

London County Council Tramways.

Differences between Early and Present Construction.—The conduit (figs. 1 and 2) is now made 1 ft. 4 in. wide instead of 1 ft. 2 in., as with the latter it was found there was not enough clearance between the conductor bars and the side of the conduit, mud accumulating and causing leakage of current. The filling used is 6 to 1 concrete, instead of 5 to 1, for reasons stated later.

The yokes are of two patterns, a short and an extended. The short one, with the exception of an extra 2 in. in width to ensure greater air-gap behind the conductor bars, is similar to the original



Figs. 1 and 2.—Sectional Elevation and Plan of L.C.C. Conduit.

pattern. It is made of cast-iron, and in section takes the form of an H girder. These short yokes are placed in the trench at distances of 7 ft. 6 in., and alternately, at distances of 7 ft. 6 in. apart, extended yokes, 6 ft. 3 in. from tip to tip (fig. 3), are placed.

The extended yokes, besides carrying the slot rails, form anchors, to which the track rails are fixed every 7 ft. 6 in. They are similar to the short yokes with the exception of the two extended arms, each of which terminates in a bolting-up face 14 in. × 7 in., each containing two slotted holes, 2 in. × $\frac{7}{8}$ in. The bolting-up face is recessed to take a hardwood packing $\frac{3}{8}$ in. thick. After placing the yokes in the trench, the slot rails are bolted on, and tie-rods are fixed between the shoulders of the short yokes and the slot rail. Track rails are laid on the extended yokes, tie-rods being used at the yokes to connect the slot and the track rails. The rails are bolted down at each extended arm by two rail clamps, held in place by four $\frac{7}{8}$-in. tee-headed bolts. The clamps, of cast-steel, are recessed to fit the flange of the rail and to sit on the bolting-up face. They are kept tight against the flange of the rail by tapered wedges and packing-pieces. To ensure that these shall not rise up when the rails are being brought to gauge, the shoulder of the extended arm is undercut $\frac{5}{16}$ in. at the bottom. The wedges are also kept from slipping out by the ends being turned over.

The tie-rods are of wrought-iron. Taper washers are provided to compensate for the angle at which the tie-rods meet the rails, ensuring the bolt going tight up, and not binding on one edge only.

When the track and slot rails are in position, the whole is packed up to line and level, and the yokes are stuck with 6 to 1 concrete.

The centering is then put in, and its construction differs considerably from that at first used. It was originally of wood, resulting in a rather rough surface to the conduit, which was not infrequently damaged in the removal of the centering.

The centering now employed is of $\frac{1}{8}$-in. sheet iron, and the methods of insertion and extraction vary. One system consists of three iron sheets, 3 ft. 9 in. long, which dovetail into each other, and are pressed out to the contour of the yokes by means of wooden wedges. The chief objection to this form of centering is that as it is withdrawn in separate pieces, sections are apt to be overlooked, and in some cases months have elapsed before they have been discovered.

Another, and in the author's opinion a better device, is that consisting of two iron sheets hinged together at the bottom and pressed out to the contour of the yokes by means of a toggle joint, the arms of which are bolted to each sheet at either end. This is extracted in one operation, the whole centering collapsing on the joint being wrenched upwards, and it can be withdrawn through gaps left for the purpose.

The centering having been inserted, the rough packings are removed from under the yokes and rails; concrete is introduced in one mass at 6 to 1 instead of, as formerly, in two operations and of different mixtures. This has the advantages of speed and saving of material.

The insulator pockets, instead of being covered by cast-iron boxes, are now covered with a cast-iron plate, 2 ft. × 1 ft. 8 in. in area, and $\frac{3}{4}$ in. thick. It has strengthening ribs running longitudinally and transversely, and a portion of the front edge next the slot rail is recessed to clear the insulator.

Before the cover plates are bedded in position the conductor tee-rail work is inserted, two improvements having been adopted, one being that the end of each tee rail is bevelled off, minimising the chance of plough shoes being caught by foul joints; and the other being that the tee rail, with the exception of the rubbing surface, is coated with a preservative paint. Paving plates are inserted between the cover and yokes to support the paving, as the concrete of the conduit next the slot-rail flange at this point is very thin and liable to crumble away. Before they were introduced the green concrete sometimes broke off, and the paving collapsed.

The paving is next laid. The positions of the insulator pits thus hidden, are indicated by square sets known as "dumplings."

These covers are considered a great improvement in some ways on the original boxes, which latter, as they became worn by the traffic, had to be replaced, and were also the cause of a great deal of dirt getting into the conduit. The chief disadvantage of the new covers, and one which may prove most serious, is that access to the insulators can only be obtained by ripping up the paving, which takes time; and in the case of a rail dropping or an insulator burning out, means considerable delay in the car traffic. In the older method of boxes, an insulator could be taken out, examined, and replaced in a few minutes. It now takes—from experiments made—three-quarters of an hour.

There are only a few miles laid with cover plates at the present time, and it remains to be seen whether they will be universally adopted.

The anchor plates at the track-rail joints, instead of being riveted to the rail flanges, are now bolted, a process which saves time and cost in maintenance.

Drainage is effected by means of sumps spaced every 40 yards along the track, instead of 60 yards, as was formerly the case. The sump consists of a concrete pit 7 ft. 9 in. deep, built in the clear way. At a height of 3 ft. 6 in. from the bottom, a concrete shelf or benching branches off under each tube.

The conduit does not run continuously through the sump, but ends flush with each wall, enabling mud to be drawn and dropped on to the shelf in each sump, from which it can be removed periodically. A flushing box is provided over each shelf, access to which is obtained through an ordinary insulator frame and cover, and the sump is entered through a manhole.

The catch-pit thus formed is connected to the sewer by a 9-in. pipe, the mouth of which is sealed with an iron hood, preventing

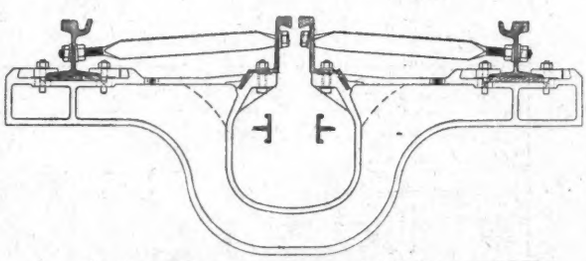


Fig. 3.—Extended Yoke, L.C.C. Conduit.

the escape of sewer gas. In outfall sewers liable to flooding, iron non-return valves are inserted to prevent water, &c., getting back into the conduits in the event of the sewer becoming surcharged.

This form of sump is an improvement on its predecessor, as the benchings which now replace the 12-in. pipe trap the mud more readily, and are infinitely easier to clean.

Rail drains are, with one or two slight modifications, similar to those originally used. The iron work being erected in one operation is a great advantage, as a much truer line and level is obtained, and with the extended yokes placed every 7 ft. 6 in., the running rails have a much firmer base and are at the same time much more rigidly anchored into the concrete bed. Renewals can also be executed with greater facility.

One or two improvements have been adopted in the construction and erection of insulators. The pin is now made with a square shoulder to prevent turning when being bolted up; there is also a piece of $\frac{3}{16}$-in. galvanised iron wire threaded through a hole in the end of the pin and twisted round to prevent the bottom nut working loose and falling off, in which case the conductor bar, losing its support, would become detached from its proper position.

The cement filling is now only inserted to within $\frac{3}{4}$ in. of the top of the porcelain cup instead of $\frac{3}{8}$ in. as formerly, as it was found that moisture collected here, and leakage of current occurred, sometimes resulting in a burnt-out insulator.

The cable connectors now in use are 2 in. longer than those

formerly employed. This increase in length was found necessary for connecting and disconnecting the cable when the current was on the line. With the shorter type it was difficult to avoid short-circuiting by the box spanner coming in contact with the slot rail or insulator casting.

Twin slot is adopted when the road is not wide enough for a double track. The two tracks have track rails in common, but instead of one slot converging into the other a second conduit is carried along parallel to it. This, beyond simplifying the slot point construction, has practically no advantages over the single-

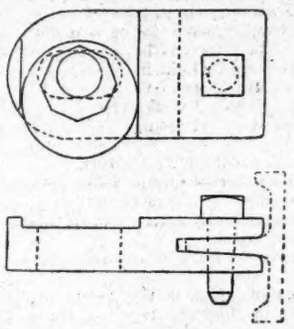


Fig. 4.—Details of Clip, with Eccentric Washer, for Adjusting Position of Conductor Rail.

line method of construction, and has the great disadvantage that should it be necessary to run a car backwards and the track points happen to be set against its returning to the line it had just left, the plough would follow the conduit of one track whilst the car might run on to the other track, thus separating the car and the plough.

An alternative method of construction is in operation, viz., the side-slot system, of which only a very short length has been constructed in London. It has been in operation in Bournemouth since 1903, and although slightly cheaper to construct, has not, in certain other respects, been entirely satisfactory. One of the slot rails forms the head of the running rail and the other forms the lip or cheek. The wear round curves with heavy traffic is found to increase the width of the slot to such an extent as to be rather

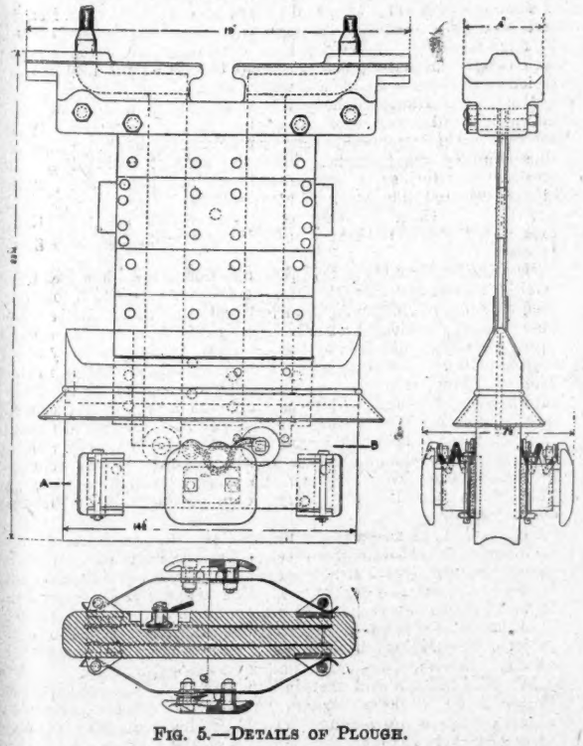


Fig. 5.—Details of Plough.

dangerous to ordinary traffic, and for that reason the system may not be generally adopted in London, where the traffic conditions are very severe, the length of line laid down being regarded as an experiment.

Electrical energy for driving the cars of the London County Council tramways is generated at Greenwich, in a new station, of a present capacity of some 20,000 h.p. It is generated at a pressure of 6,600 volts, alternating current, and at that pressure is transmitted by means of copper cables to various sub-stations, each of which feeds a separate district. Power was originally obtained from various electric supply companies and from the Council's own or other companies' plant, but now the whole energy is derived from Greenwich, power being taken from one company only on occasions of overload.

The second section of the Greenwich generating station is now under construction, and, when completed, about 50,000 h.p. will be available.

The current on being received at a sub-station is converted from alternating to continuous current at a pressure of 550 volts by motor-generators (synchronous and asynchronous), and transmitted to the different feeding points in each district, there being a feeding point to every ½ mile section.

The current is transferred from the conductor bars to the motors on the cars by means of a plough (fig. 5), which is suspended on two horizontal bars or slides fixed to the car truck, and is free to traverse the entire width of the car.

The plough consists of a main body of a rubber composite material, through which the two insulated leads pass, terminating in two rubbing surfaces, one on either side of the body, called shoes. These are made of cast-iron, and are attached to the main body by means of springs and links, and the former, when fully expanded, leave the two surfaces 7 in. to 7½ in. apart.

When the plough hangs in position between the conductor bars, each spring has to be compressed ½ in., thus keeping the rubbing surfaces of the shoes pressing against the two conductor bars. The actual connection between the motor leads and the shoe is made by a small flexible conductor, which, on occasion, acts as a fuse.

Some reference to the difficulties to be overcome during reconstruction when inserting junctions, &c., into existing electric conduit lines, carried out whilst the car service is maintained, may be of interest. Such work is accomplished in the following manner:—

The line is first thrown dead; the conductor bars are removed, and the old conduit and track foundations broken out, cars being run over the existing rails, which are packed up temporarily for the purpose. Traffic is suspended for a few hours during one night to enable the old ironwork to be replaced by new, which is packed up in the same manner, to allow the cars to run until it is possible to suspend traffic again for a short time, when the new conduit is formed and concrete foundations, &c., inserted. Traffic has once more to be suspended during the night in order that the conductor bars, jumpers, &c., can be replaced.

The difficulties of general construction work are greatly increased owing to the many obstructions which have to be encountered. Pipes, cables, &c., require to be diverted, on account of being laid at such shallow depth, before the conduit can be excavated or, as often happens, during its actual construction. Some of the most notable examples on the London lines occurred in Nine Elms Lane, where several large mains, including some 27 in. and 36 in. in diameter, had to be diverted, in addition to sundry small pipes throughout the whole length.

The conduit system of tramway construction has been greatly criticised, chiefly, however, on account of its greater cost of construction and maintenance compared with that of the overhead system, but very little has been proved against it as regards its general efficiency in operating. It has many points to recommend it, amongst others, that it is much more sightly than the overhead system, there being no standards or overhead wires to disfigure the street.

It has a possible rival in the surface-contact system. The London County Council are at present experimenting with a short length of the "G. B." (Griffiths Bedell) system.

The comparative average cost of the conduit, surface-contact, and overhead systems, is as follows, but it must, of course, be noted that in every system the cost of construction varies greatly, according to the nature of the obstructions and the extent of special work necessary:—

	Per mile (single).
Conduit (including special work, pipe diversions, &c.)	£17,000
Surface contact " " "	£9,700
Overhead " " "	£9,200

Sodium by the C stner Process.

Lecturing at the Royal Institution on January 17th, on "The Centenary of Davy's Discovery of the Metals of the Alkalis," Prof. T. E. Thorpe gave the following account of the method whereby the late Mr. H. Y. Castner adapted the principles laid down by Davy and Faraday to the needs of modern industries. It is by Castner's process that all the sodium of to-day is manufactured:—

In the Castner process melted caustic soda, produced by the electrolysis of a solution of common salt by a method also devised by Castner, is brought into an iron vessel shaped like a large cauldron, mounted in brickwork, and provided with an extension adapted to receive the negative electrode. Suspended directly above the cathode is an iron vessel attached to a lid; to its lower edge is secured iron wire gauze, which when the receptacle is in position, completely surrounds the cathode. The positive electrode is connected with the lid of the vessel, which is provided with openings for the escape of the gases resulting from the electrolysis, and is suitably insulated.

As the electrolysis proceeds, the alkali metal, being much lighter than the molten caustic, rises from the negative electrode and passes into the receiver, the gases escaping around the edges of the cover. The molten metal collects on the surface of the caustic, and is removed by means of a large perforated spoon, the perforations enabling the melted caustic to flow out, while the metal remains in the spoon. As the several vessels are thus skimmed in succession

the fused sodium is collected into an iron vessel, whence it is poured into moulds, in which it congeals, forming blocks of the size and shape of an ordinary building brick. These, after being trimmed to remove adherent oxide, are immersed in paraffin oil, and are then packed into large iron drums, holding about 6 cwt. or 7 cwt., capable of being closed air-tight, and protected in transit by an outer casing of wood.

The due regulation of the volume and intensity of the current is a matter of the greatest importance in order to obtain the most economical yield of the metal. No very high temperature is needed; indeed, the temperature of the fused caustic soda should not be much higher than that of its melting point. By suitably regulating the current, the soda, in fact, may be maintained at the proper temperature and in the proper degree of fluidity without extraneous heat. Fresh melted caustic soda is added to the vessel from time to time to replace the metal removed, and in this manner the process is made continuous.

The Castner process is now worked in England at Wallsend-on-Tyne and at Weston Point, in Cheshire; at Rheinfelden, in Germany; at Clavaux, in France; also in Switzerland, and at Niagara, in America. The present yearly output amounts to about 5,000 tons, but the plant already laid down is capable of producing at least twice this quantity.

The greater quantity of the sodium made in England is sent to Glasgow, where it is converted into sodium cyanide by the Cassel Cyanide Co., for use in the extraction of gold. As gold is, I suppose, generally considered the principal material factor in procuring the comforts and conveniences of life, Davy's great discovery may be thus said to have secured the primary object which the projectors of the Royal Institution had in view. Other important uses of sodium are in the manufacture of peroxide for bleaching purposes, of artificial indigo and of a number of other synthetic dye stuffs and of drugs like antipyrin.

It need hardly be said that this extraordinary development of the manufacture has not been without its influence on the price of sodium. A quarter of a century ago it was a comparatively rare metal, and a stick of it was regarded as a chemical curiosity, to be handled with circumspection and care. Even as late as 1890 its selling price was as high as 8s. per lb. To-day it is 8d. Sodium now takes rank, therefore, with zinc, tin, copper or aluminium as a common, ordinary metal of commerce.

Standard Notation for Engineering Formulæ.

(A discussion at the Civil and Mechanical Engineers' Society, *January 2nd*, 1908.)

In opening the discussion, the President (Mr. W. Noble Twelvetrees) said that the subject before the meeting was of a very wide scope, and applied to symbols employed, or recommended for employment, in all departments of engineering practice. But in view of the fact that an international system of notation might eventually be established for electric formulæ, it would, perhaps, be thought desirable that the symbols for use in such equations should be allowed to stand by themselves. A circular letter had been addressed to all members of the Society, and to others known to be interested in the derivation and application of engineering formulæ, inviting expressions of opinion on the subject of standard notation and the presentation of schedules of proposed standard symbols, and numerous replies had been received. The first thing that they, as engineers, ought to do was to formulate a code of notation suitable for all the factors in general use, and then to confer with those engaged in the pursuit of the more mathematical branches of science with the object of ascertaining whether a common code of notation could be settled for such factors. He could not help thinking that the greatest obstacle to standard notation was the entire absence of any organisation for the interchange of views between those who were primarily responsible for the publication of engineering formulæ, and who, so long as they were obliged to act independently, could not well avoid the perpetuation and multiplication of conflicting symbols.

The confused state of engineering notation was illustrated by haphazard reference to half a dozen treatises by different writers on any branch of engineering work. In the case of five formulæ for the moment of resistance of reinforced concrete beams, notwithstanding their apparent dissimilarity, all these formulæ were based upon the same theory, and if rewritten with standard symbols they reduced to absolutely identical terms.

Prof. C. W. L. Alexander, of Queen's College, Cork, wrote, urging that double symbols should be avoided as far as possible, as they were most mischievous, and the source of many errors. Such were: f_r, f_b, H_c, H_c, &c.

Prof. F. W. Burstall wrote that it was most desirable as far as possible to use certain symbols for certain quantities, and to use suffix letters to distinguish similar quantities; as for the specific heats, K_p, K_v.

Prof. Andrew Jamieson wrote that he had been anxiously looking forward to such a meeting of practical engineers as the present one for the past 23 years. In 1884 he had written a paper for the Institution of Electrical Engineers upon electrical definitions, nomenclature and notation. A Select Committee was formed, and a complete and excellent set of electrical definitions and nomenclature was printed. The part on notation was, however, left over to be decided at the 1893 International Electrical Congress in Chicago, and the symbols then recommended had been generally adopted by most electricians and engineers. These subjects would be brought forward next year for revisal by an International Committee in London.

He had done his best to pave the way for a gradual adoption by engineers of a common-sense and easily remembered system of notation by printing at the beginning of each of his engineering text-books tables of notation, and had adopted a system of indexing his diagrams and figures of machines, whereon the first letter of the chief noun or most important word had been used to indicate the part, and (where it appeared necessary) the first letter or letters of the adjective (or qualifying words) had been added as a suffix letter or letters

Mr. E. Fiander Etchells wrote that the use of the initial letter would generally give them an unforgetable mnemonic, but the real problem showed itself as soon as it was attempted to select the words which were to be cat down to their initial letters. The problem only appeared to be one of notation. The real problem lay deeper; it was largely one of nomenclature. The following principles might, in his opinion, have been accepted as a guide to the election of symbols:—

1. The principle of the initial letter.
2. The reasonable acceptance of all that was already standardised.
3. The abolition of all double symbols.
4. All subscript letters should be self-explanatory.
5. The "superscript" position or the right-hand top corner of a letter should be exclusively reserved to represent powers or roots of that letter or number.
6. Advantage to be taken of the difference between capital and small letters.
7. The Greek alphabet to be used very sparingly.
8. Use of the initial and the second letter where necessary to avoid confusion, as was done in chemistry, or even the initial and last letter.
9. A due regard to classification of ideas and data in the selection of terms.

Mr. J. Rennie said the question was an extremely wide one. There were certain letters which had been attached to certain meanings for a long time; and it seemed to him to create a difficulty if, in any method of standardising, they set about changing these. It would be necessary that they should change them, however, for they found letters which were fundamental in the theory of heat equally fundamental in electrical science, and used in such a way that they could not be changed. The question should be for different symbols to be attached to several branches of engineering. Take, say, the department of heat, and settle what letters were to be used in all formulæ referring to questions of heat. Then, quite independently of that, approach mechanics and start afresh, and deal similarly with electricity and magnetism. He did not think there would be much trouble from the crossing of these meanings, because when a man was dealing with electrical matters he had not usually in his mind mechanical things.

Major E. M. Paul, R.E., said that he echoed all that Mr. Rennie had said. He advocated strongly the recommendations of Mr. Fiander Etchells. It would not be possible to avoid dual significations for some letters, but he anticipated little likelihood of confusion in the end, if a standard was recognised and adopted.

Mr. F. R. Durham thought that if they could reduce the numbers of different ways of expressing the same quantity to something which produced a smaller number of symbols, they would thus simplify the formulæ. Take the case of hydraulics. In measuring water, some measured in gallons per minute, while others measured in gallons per hour, and yet others in cubic feet and units of time. If they could standardise some of those expressions, they would be standardising the notation to a great extent.

Mr. Leslie Robertson said that one difficulty he had met with was this: more and more they were getting in touch with formulæ used abroad, and, of course, the notation there was not the same as here, and they could not exactly transfer all the symbols used in foreign work into different symbols. Therefore, very often symbols used abroad had found their way into text-books circulated in this country. This made it a very difficult question, because it was an international one, and the international side of the matter assumed more importance than at first sight appeared. Another difficulty was that there were certain time-honoured works, such as Rankine's, in which certain symbols were used, and no doubt, in any reprints or reproductions, the same symbols would continue to be used. There was a great difficulty, therefore, in getting a standardisation of symbols.

Mr. C. T. A. Hanssen in all rational formulæ recommended the exclusive use of absolute pressures, as formulæ containing symbols for gauge pressure gave rise to erroneous ideas. He considered it impossible to get a single set of symbols to apply to all the various branches of engineering, and he did not think that it was advisable to attempt this. It would be better to get a set of symbols for each subject, overlapping as little as possible, but at the same time retaining those symbols which had come into general use.

Mr. W. B. Esson said that in the different symbols employed by about 60 different writers there were no fewer than 30 different ways of expressing Ohm's law, which could be expressed by merely three letters. The sinners were the authors. The more clever and original an author was, the more reckless he was with his symbols. He proposed the following resolution:—"That, in view of the desirability of adopting as far as possible a standard notation and nomenclature for engineering formulæ, this meeting of the Civil and Mechanical Engineers' Society requests the Council to approach the Engineering Standards Committee, the universities having engineering faculties, the leading engineering institutions, societies and associations in the United Kingdom, with the object of bringing about concerted action in the matter, or to take such steps as may, in the Council's opinion, best conduce to this end."

This was seconded by Mr. C. T. Alfred Hanssen, with the

substitution of the words "British Empire" for "United Kingdom."

Mr. Guy said that Americans had already adopted a standardised system to a limited extent. They used the French nomenclature in connection with electrical matters.

Mr. R. H. Parsons said that one way in which the societies could help would be to insist upon the authors of papers using a standard notation.

Mr. A. S. E. Ackermann objected to the use of capital letters for values in feet and small letters for values in inches, because it meant a double set of symbols for the same things. If symbols were defined quite irrespective of units, then they could be used with the metric or any other system. He liked the idea of using initial letters as symbols. When letters were used which had nothing to do with the things they represented, they gave the brain more to do. Authors should state at the beginning of their books that they had adopted the standard notation, and they could also define such standard symbols as they used. In electrical engineering, hydraulics, and other branches of science, the symbols might have different uses.

The foregoing resolution was then put to the meeting, and carried *nem. con.*

Magnetic Oscillations in Alternators.

By G. W. Worrall, M.Sc., M.Eng., Associate Member.

(Abstract of paper read before the Institution of Electrical Engineers *at Manchester, January 14th,* 1908.)

Pursuing the subject which he dealt with in a previous paper, the author investigated the conditions controlling oscillations in the main magnetic circuit, and locally in the pole-face and air-gap. The same machine as before was used, with special laminated pole-pieces having a polar arc approximately six times the tooth-pitch. The oscillations were observed by means of search coils, and the polar arc was varied by planing off the tips by degrees; the values of the oscillations found are shown in the accompanying table as percentages of the total flux. By plotting a curve with these values, it was shown that the magnitude of the oscillations varied from a maximum when the polar arc was six times the tooth-pitch, to a minimum when the ratio was 5·5. By means of the oscillo-

Polar arc / Tooth-pitch	Pole shoe.	Limb.	Yoke.
6·028	0·206	0·0094	0·0097
5·920	0·194	0·0072	0·0073
5·820	0·119	0·0060	0·0061
5·710	0·051	0·0036	0·0036
5·500	0·039	0·0032	0·0032

graph it was also shown that the ripples on the summits of the half-waves, due to the passing of the teeth beneath the pole-pieces, increased very considerably as the polar arc was reduced, and were at a minimum when the magnetic oscillations were at a maximum; the E.M.F. also increased as the ripples increased.

Examination of the stray field showed that it was very small in extent, and by means of drawings of the relative positions of pole-piece and teeth, it was found that, with the polar arc an exact multiple of the tooth-pitch, the effective surface under the pole-piece varied by one tooth, whereas, with the polar arc 5½ times the pitch, the effective surface remained constant, but shifted from side to side by the width of one tooth. Thus, in the former case, pulsations were set up throughout the magnetic circuit, while in the latter the oscillations were confined mainly to the air-gap, these results coinciding with those experimentally obtained.

The frequency of the ripples on the waves of E.M.F. is the same as that of the magnetic oscillations, *i.e.*, the number of teeth passing a pole per second, and the pulsations in the main flux represented by the ripples are at a maximum when the armature coil embraces the pole-piece—*i.e.*, when the E.M.F. is at a minimum; but when the pulsations are at a minimum and the flux swing a maximum, the ripples occur on the top of the E.M.F. waves, as shown by experiment, as the sides of the coil are then under the pole-pieces. Similar results were obtained with other machines.

The author also investigated the flux displacement caused by the local magnetic flux due to the conductors carrying current in a slot, and found that a backward displacement took place when the current was in the same direction as the main E.M.F. generated, and forward when the current was opposed in direction to the E.M.F.

Electrical Production of Steel.—It is announced that the Electro-Steel Installation Co. (Gesellschaft für Elektrostahl Anlagen), of Berlin, has arranged a community of interests with the Gröndal-Kjellin Co., of London. The latter owns and promotes the use of the English and American patents for the Kjellin induction furnace and the Gröndal process for the preparation and briquetting of iron ore. The arrangement in question confers upon the English company the right of turning to profit the induction furnaces according to the Röchling-Rodenhauser system in England and the British Colonies, and in the United States.

THE ELECTRICAL TRADE OF ARGENTINA.

In an article recently published in the *Elektrotechnische Zeitschrift*, Dr. Glies, of Berlin, draws attention to the vast opportunities existing in Argentina for the expansion of the electrical trade. During the last few years there has been a great development of trade in this country; in 1895 the value of the total imports was 95,100,000 pesos (about £19,000,000); in 1900 this value had increased to 114,000,000 pesos (about £25,000,000); and in 1905 to 205,100,000 pesos (about £41,000,000); the value of the exports in the same period had increased from 120,100,000 pesos (£24,000,000) to 332,800,000 pesos (£65,000,000). The buying power of the country has greatly increased during this period as a result of the valuable harvests which have been reaped recently; that this buying power is rather above the normal cannot be denied, but there is every reason to suppose that it will not decrease to any very great extent. The influx of foreign capital for the construction of railways and public works has also largely increased the buying power of the country as a whole; so much so, that in 1906 transport materials to the value of 35,050,000 pesos (£7,000,000) were imported. It is impossible to anticipate that this importation will continue, but the railways which have resulted have greatly facilitated exportation, and consequently will have a lasting effect on importation. The imports of electrical material have also taken part in the general increase; in 1901 the value amounted to 635,000 pesos (£127,000), and by 1906 had consistently increased to 3,430,000 pesos (£686,000). In the first half of 1907 the imports amounted to 1,621,000 pesos (£324,000), as against 1,089,000 pesos (£218,000) in the similar period of 1906. The very best hopes may, moreover, be anticipated for the future of this trade. In 1902 the German Commercial Agent at Buenos Ayres reported that in 1897 the first electric tramway was constructed in Buenos Ayres, whereas in that year (1902) large electrical works for lighting and power purposes existed not only in the capital, but also in numerous provincial towns. Further works were also projected in many towns, and electrical machines, ventilating fans, lifts, &c., were being used more and more extensively. Moreover, electric tramways were proposed in many towns. When these statements are taken into consideration, the importance of the extension of the utilisation of electricity in late years, and the consequent increase in importation can at once be appreciated, but it is amazing to find what a short time has elapsed to allow of the change which has taken place. In view of the great increase in the importation, the question may well be asked whether this importation is going to continue, or whether a temporary set-back may be anticipated. It must be taken into account that the population of Argentina amounts to only 5,500,000, *i.e.*, not two persons per square kilometre. Consequently, the field for electrical enterprise is more or less limited, and must remain so for a few years at least. It may, therefore, be presumed that the rate of increase which has been shown in recent years cannot possibly continue, at least for the present, but there is still considerable work to be done, such as the installation of telegraphs and telephones, electric lighting, &c., which, if the financial condition of the country continues sound, must entail large importations of electrical materials. It is possible that some decrease may even be shown in future years, but with the development of the country and the increase of population which must necessarily come in time, the trade in electrical goods may be expected to increase to a very great extent after a temporary set-back.

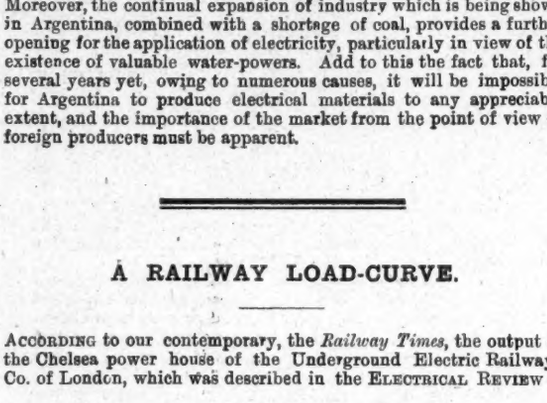
In 1905 Germany held more than half the total trade of Argentina in electrical goods, *i.e.*, 1,126,000 pesos, out of a total of 2,035,000 pesos. The development of the trade by various countries since 1901 has many interesting features. In that year the imports from Germany amounted to 150,000 pesos, from which figure they have gradually and consistently increased; the imports from the United States in 1901 amounted to 279,000 pesos, by 1903 they had decreased to 98,000 pesos, and then increased to 175,000 pesos in 1905; the imports from Great Britain in 1901 amounted to 259,000 pesos, in 1902 to 219,000 pesos, in 1903 to 398,000 pesos, in 1904 to 265,000 pesos, and in 1905 to 466,000 pesos. It will be seen, therefore, that the imports from Germany in 1905 showed an increase of about 650 per cent., whereas the imports from Great Britain showed an increase of only 80 per cent. It would certainly appear from these figures that Germany has secured a position in the market which it will be very difficult, if not impossible, for other countries to regain. This position must to a great extent be the result of the investment of capital in the country, a feature in which Great Britain seems to have been particularly backward, so much so, that enterprises, such as tramways, gas companies, &c., which were formerly in the hands of British capitalists, were allowed to be taken over by German competitors when electricity was introduced. And now, until concessions expire, Germany having a firm hold of the enterprises of the country must be expected to gain the greatest share of the trade. There seems to be no reason, however, why British capitalists should not to some extent undo the harm which has been done by interesting themselves in the new enterprises that must spring up in a trade which is all-important to a country like Argentina, so that when present concessions do expire they may be in a better position for obtaining a greater share of the trade which exists at present, not to speak of the trade which must result in the future from the extended application of electricity in all its forms.

In concluding his article Dr. Glies states that Germany has secured absolute predominance in the electrical trade of Argentina, a condition of affairs which cannot be expected to change in the near future. In considering the position of the market, it must

necessarily be anticipated, as has already been stated, that a decrease will be shown in the import figures for some little time to come; but by this it must not be understood that Argentina is worked out from an electrical point of view. The fact that so many electrical enterprises exist must of itself ensure the importation of large quantities of electrical materials, without taking into account the possibilities of the establishment of new enterprises. Moreover, the continual expansion of industry which is being shown in Argentina, combined with a shortage of coal, provides a further opening for the application of electricity, particularly in view of the existence of valuable water-powers. Add to this the fact that, for several years yet, owing to numerous causes, it will be impossible for Argentina to produce electrical materials to any appreciable extent, and the importance of the market from the point of view of foreign producers must be apparent.

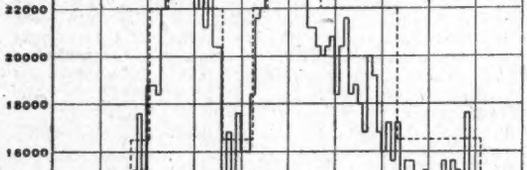
A RAILWAY LOAD-CURVE.

ACCORDING to our contemporary, the *Railway Times*, the output of the Chelsea power house of the Underground Electric Railways Co. of London, which was described in the ELECTRICAL REVIEW of



DAY LOAD-CURVE, CHELSEA POWER STATION.

June 9th, 1905, now amounts to about 100 million units per annum, some five of the 5,500-KW. units being in service. The first load-curve shown, that for Saturday, January 4th last, is an



DAY LOAD-CURVE, 5,500-KW. TURBO-GENERATOR.

exceedingly interesting one, the dotted lines showing the capacity of the generators on load, and the full line, the fluctuations occasioned by the train movement, which on account of its being a Saturday load, attain their maxima at 8 a.m. and 2 p.m. approximately. These peaks correspond to 29,200 KW. and 26,000 KW. respectively, and the generator output for the 24 hours amounts to 376,800 KW.-hours. This latter load was some 33,000 KW.-hours in excess of the normal on account of the heater load on the District trains, the day being frosty.

The heater load averages 5½ units per car per hour on the 300 cars in use during the day. The early morning load represents the energy used in permanent-way work in the tunnels, &c., depôt lighting, shunting operations and heating the cars to maintain the compressed-air brake apparatus in order; this load never gets less than 1,000 KW.

The second diagram illustrates the output of one 5,500-KW. generator during a day, the output—128,300 units—representing 97·2 per cent. of the normal full-load output during 24 hours.

It will be seen that the machine was overloaded to some extent for 19 hours out of the 24.

ELECTRICITY IN PERU.

By EMILE GUARINI.

ON account of its economic, geographical and industrial conditions, Peru offers inviting possibilities for the applications of electricity. There are many large water powers which could be easily and economically utilised. It is true that here and there there are coal deposits of great magnitude and very good quality, but means of transportation are so rare, and nearly always so expensive, that at only a few miles from the mines the price becomes prohibitive. On the other hand, the need of labour in sufficient quantity and at reasonable prices, makes itself felt more and more each day. For the present, at least, proper immigration cannot be counted upon. It is true that of late there has been a variable Chinese invasion, but apart from the fact that these yellow immigrants remain in Lima, this kind of immigration is not at all desirable; principally, because of the gross lack of education among them. All of them become small retail merchants, and they are far from being honest in their trading.

On account of these facts, electric transmission with modern machines may become of great value. The industrial people of North America were quick to realise this, and they have made great efforts to put themselves on a solid basis in the Peruvian market. Their representatives, who speak Spanish, travel through the different regions and nearly always make acceptable conditions of sale.

As far as the electrical industry is concerned, it is only right to recognise that the United States owes a great deal to the efforts of Grace & Co., who represent the General Electric Co. both in Peru and in the neighbouring countries. At the present, however, various European electrical constructors also have representatives in Lima, one consequence of which has been the suppression of the nearly absolute monopoly that was formerly held by Grace & Co., and a lowering, truly fortunate for the industry, of the price of electrical supplies and the cost of electro-mechanical installations. Previous to a few years ago nearly all the electricians and mechanicians were foreigners, mostly from North America. Now things are changing completely, with great advantage to the national industry. There have returned to Peru many young men who have been studying mechanical and electrical engineering in the United States. Furthermore, there has been established a national school of arts and trades, which turns out technical specialists and also workmen. In this school there is a section especially for electricians. Next year at the engineers' school there will be opened a special course in advanced electrical engineering.

To return to the interesting question of the electrical market in Peru, it should be added that the North Americans find, and will find, powerful competitors in the Germans. Whatever be the final result of this struggle, there is no doubt that it will be advantageous for the Peruvian industries. It is noteworthy, however, that the people of the United States have studied the local conditions better than have those in Europe, and the former people have more confidence in the brilliant future of this country. To illustrate, it is sufficient to say that while the General Electric Co. constructed and sent to a gold mine at Santo Fomingo in the interior of Peru a three-phase generator, rated at 300 H.P., which could be transported on mule-back, many European houses stated that it was impossible to construct a machine larger than 50-H.P. which could be transported in this manner. There were certain people of this class, who, instead of studying the special types, seriously advised the construction of special roads to make it possible to transport machinery by wagon.

There are electrical installations all over Peru which are more or less important. Electricity is used principally for public and private lighting, and for application in the mines. Electric street railways have been used for city and interurban service only in Lima. As would naturally be supposed, the largest and most important installations are to be found in the neighbourhood of Lima. For feeding its distribution system for lighting power and traction, Lima possesses a number of hydraulic installations, which are probably the most notable in South America.

At present there are two hydro-electric stations and one auxiliary steam station. The first is constructed at the foot of the Andes, and is that of Chosica; it utilises a fall of 40 metres, and a flow of 5 cubic metres per second. The second is at Lima, and utilises a fall of 25 metres. The Chosica station is about 40 kilometres from Lima. The water is conducted from a concrete dam constructed

200 metres above the station, by a canal 3 metres deep and 8 metres wide; this canal ends in a reservoir, where sand and gravel are allowed to accumulate. The water drives three groups of three-phase generators which produce current at 2,300 volts, and the transformers raise the E.M.F. to 33,500 volts. At this E.M.F. energy is transmitted to Lima by two independent lines. The poles are made of white cedar, and are from 9 to 10 metres long. The central station of Polvora (Lima), which also serves as a sub-station for the Chosica station, is fed by a reservoir having a capacity of 54,000 cubic metres, and through a penstock 600 metres long and 75 centimetres in diameter. In the steam auxiliary plant there is, among others, a Curtis turbine rated at 1,000 H.P.; crude petroleum is used as fuel.

There are three sub-stations: one at Legrna to feed the Lima-Callao Railway, one at Miraflores to feed the Lima-Chorrilos Railway, and one at Lima for the city railways. At Polvora the E.M.F. is reduced to 10,000 volts; the second transformation reduces it to 2,080 volts, and the last to 104 volts, which is the E.M.F. of the distribution system.

Arc lamps in series and incandescent lamps are used for the public lighting in Lima. In private lighting, the flat rate of $1 a month for each 16-C.P. lamp prevails. Previously, for different reasons, people have been more or less opposed to the introduction of the watt-hour meter, but now they are becoming more reasonable. By the meter method, energy is sold at 15 cents per KW-hour, while the H.P. month costs from $3 to $4, according to the rating of the installation and the number of hours of use per day.

In general, the installations which are in service demand many urgent reforms. This will be possible now that several of the enterprises have united to form a trust. The companies do not obtain all the profit that it is possible to derive from the stations. Besides introducing desirable modifications in the present lighting and power service, they will be able, advantageously, to enter the true field of electrical industry, that is, electrical refining. The city railways of Callao and of Chorrillos will be merged in the trust. The first of these systems has a network of 38 kilometres, and began operation with 35 cars, which number has recently been increased. The Callao Railway is 14 kilometres long, and the Chorrillos Railway 16 kilometres long. The capital of the trust is about $11,000,000. At present a loan of $5,000,000 is being negotiated for increasing and improving its installations. In a few months the electrical trust will have finished its third hydraulic station at Chacra Sana, 4 kilometres below the Chosica station. It will utilise the same waters of the Rimac. It is expected in this manner to develop 6,000 additional horse-power, with which it will be possible to introduce certain desirable changes in the service and, probably, also, to lower the prices. It may be added that the electrical trust has lately leased, for a term of years, a steam railway between Callao and Chorrillos, a distance of 30 kilometres. It will pay $70,000 a year, and after having electrified it, a much better service will be established for the transportation of freight.

In a short time, also, the railway of the Compania Nacional de Tranvia Electrico, which, in addition to its city service, will inaugurate a service between Lima and Herradura, 1 kilometre beyond Chorrillos. The central station is finished, and the line is almost completed. The capacity of the central station at Miraflores will be increased by about 1,000 H.P. The electrical apparatus was furnished for the most part by Siemens-Schuckert, of Berlin. Internal combustion engines are used, with crude petroleum as fuel. The installations of this last company have cost up to the present moment about $750,000.

At Arequipa the electric generators which furnish electricity principally for lighting are driven by turbines which receive water from the Chili, under a head of 26·5 metres, through a canal 1,900 metres long. The flow of water is about 4 cb. metres per second, corresponding to a gross power of 1,413·33 H.P., or 1,060 H.P. net, at the turbine shafts.

The station built by the Sociedad Electrica is located at Charcani, at a distance of 13 kilometres from the city of Arequipa. It contains two turbo-alternator units, 248 H.P. each. The turbines require 865 litres of water per second, and the generators produce alternating current at 5,400 volts, and a frequency of 50 cycles per second. The third unit, rated at 538 H.P., which produces three-phase current at the same voltage and frequency, is connected to the power network during the day, and the lighting network during the night. The station at Charcani represents altogether about 1,000 H.P., or about 730 KW., which is transmitted to a sub-station in Arequipa over a line 12·5 kilometres long, consisting of eight wires, each having a cross-section of 16 sq. mm., carried on 240 poles. The fall of pressure in the line is relatively large. Taking into account the loss in the transformation and in the distribution system, the useful power amounts to about 80 per cent. of that produced at the station; or—

$$\frac{80 \times 75}{100 \times 100} = 60 \text{ per cent.}$$

of the power in the water. These results may be considered as satisfactory, and the hydro-electric station at Charcani is certainly under present conditions one of the best in the country.

For a couple of years experiments have been made at Lima with storage-battery omnibuses, using an American system. The results have been disastrous. The cars were poorly conceived, and badly calculated. They were provided with two 2-H.P. motors, absolutely insufficient to give a moderate speed with a weight of 7 tons (passengers included). The storage batteries were ruined in a few months. At present the writer is changing the motive-power from storage-battery to the gas-electric system. The car is running very well at present, and will run better still when the electric motors have been changed. The electrical part of the equipment has not been changed; the batteries have simply been replaced by two dynamos and an alcohol motor. The two dynamos can be connected in series or in parallel, as was formerly the case with the two batteries.

Huacho possesses a modest hydro-electric installation, somewhat similar to that in Poroto, at Trujillo. It was installed by the Peruvian representative of Siemens-Schuckert. This last installation was made in 1903. The canal is 2,400 metres long, and has a capacity of 1,000 metres per second. The fall utilised is 61 metres, the penstocks being 180 metres long and 65 metres in diameter. The station contains two 250-H.P. units, which produce three-phase current that is transformed to 10,000 volts and used for transmission to Trujillo by a line 35 kilometres long, there being three conductors each 10 sq. mm. in section. The insulators were tested at 40,000 volts. At Trujillo the E.M.F. is stepped down to 220 volts, the pressure of the distribution system. The entire installation, which cost $90,000, feeds, besides a few electric motors, 1,770 private lamps and 470 lamps for public lighting. In the valley of the Tambo, at the works (sugar factory) of M. Lira, is installed a modest electrical installation which, during the day, supplements the hydraulic power, and during the night lights the factory and the neighbouring dwellings.

At Cerro de Pasco Mr. Solomon Tello has a small hydro-electric installation for the public and private lighting of this important mining centre. Because of the insufficiency and the intermittent character of the flow of the water, this gentleman is at present building another station in which the supply of water will be more constant.

In the same region is located the Rio Blanco station of the Italian mine-owner, Fernandini, and that of the Cerro de Pasco Mining Co. The former contains two three-phase 700-H.P. units. The high-tension system, having a total length of 22 kilometres, passes through the mines and the foundry, and ends at Cerro de Pasco. The installations of the Cerro de Pasco Mining Co. are located at Smelter, about 25 kilometres from Cerro de Pasco. Because of the coal deposits in the neighbourhood, steam power, instead of water power, is used for this plant. This was not done because of the lack of water power, but simply to save time. It would evidently be desirable to diminish the expenses by constructing a hydraulic station, leaving the present steam station to act as an auxiliary. In the power station is a Westinghouse three-phase 440-KW. generator, coupled directly to a Norberg cross-compound engine, and a 50-KW. direct-current generator to supply electricity for the laboratories. In a short time it is expected to double the capacity of these stations. When the stations are finished, the total power installed will be 1,600 KW. In all electrical installations around Cerro de Pasco great precautions had to be taken to avoid the disastrous effects of atmospheric electricity, the altitude being 4,000 metres.

The installation which holds the world's record for altitude is a small 25-H.P. hydro-electric station which supplies energy to the Alpamina Mine. This line is more than 5,000 metres above the level of the sea. The electricity is generated directly at 3,000 volts and transmitted about 8 kilometres.

In addition to the above-mentioned installations, there is a great number of electric mining stations. The writer estimates the aggregate ratings of the electrical machinery installed in Peru as about 50,000 H.P. Doubtless under the favourable conditions which the electrical industry meets in Peru, it will before long be greatly increased.

THE GERMAN ELECTRICAL INDUSTRY.

The time-honoured custom of attempting to forecast the probable financial results of industrial companies during the past financial year is now being observed on the Berlin Stock Exchange, where the practice is followed to a considerably greater extent than in any other country. Apart from the actual figures which have already been published respecting certain undertakings, it is predicted that the Accumulator Works Co. will be able to declare a dividend of 12½ per cent. as in the previous year; the Accumulator and Electricity Works W. Bose, from 4 to 5 per cent., as against 2 per cent.; the Bergmann Electricity Works Co., 18 per cent., as in 1905-6; the German Atlantic Telegraph Co., 7 per cent.; German Netherlands Telegraph Co., 6 per cent.; German Cable Works, 7 per cent.; Felten & Guilleaume-Lahmeyer Works, 11 per cent.; Mix & Genest, 9 per cent.; and the Rheydt Electrotechnical Works, 8 per cent. The rates in these particular cases are the same as those paid in the preceding financial year.

The Barcelona Electricity Works Co. is foreshadowed as likely to distribute 7½ per cent.; the German Transmarine Electricity Co., 9½ per cent.; the Electric Supply Co., 10 per cent.; and the Berlin Company for Electrical Enterprises, 8 per cent. These figures also represent the rates which were paid for the previous year. The summary of certain of the leading firms, which was given in the REVIEW on December 6th, 1907, may now be supplemented by the following details:—

The Siemens-Schuckert Works Co., which is composed of the heavy electrical engineering departments taken over from the Schuckert Electricity Co. and the Siemens & Halske Co., which hold the entire share capital in almost equal halves, has issued a report for 1906-7. The report refers to the issue of a 4½ per cent. loan of £1,000,000 during the past year, and states that the capacity of the works at Charlottenburg, Nuremberg and on the Nonnendamm in Berlin, was very much strained. Notwithstanding the exercise of the greatest reserve, the company were compelled

to carry out large extensions both at Nuremberg and on the Nonnendamm. The final results for the year are undernoted:—

	1906-7.	1905-6.
Share capital	£4,500,000	£4,500,000
Loan capital	1,000,000	—
Gross profits	866,079	627,392
Depreciation provision	270,500	118,894
Net profits	508,276	449,936
Profits distributed	449,329	404,500
Profits distributed equal about percentage of	10	9

The report states that the number and average output of the turbo-generators built experienced a considerable increase. The development of the construction of transformers led to the production of units of 7,000 KW. and a working pressure of 66,000 volts, and six transformers of 4,000 KW., and each of 22,000 amperes secondary current density were delivered for a large carbide of calcium works. In a similar way the demands increased for larger capacity starting and switching apparatus. For instance, the company constructed a water starter for 2,000 H.P., and an oil switchboard for 25,000 KW. at 10,000 volts was the largest switchboard made. This heavy apparatus led to further progress in the manufacture of apparatus for distant control and answer by means of signal lamps. In the case of central stations, the requirements were greater in regard to the maintenance of a constant working pressure, even if large units have to be switched in or out. The works built direct-current reversing motors with unit outputs up to from 8,000 to 10,000 H.P. and a speed of from 60 to 100 R.P.M. Various orders were booked for main winding engines, and electrically operated pumps had almost completely driven out steam pumps. As far as the railway department is concerned, the report mentions that it was well employed on the construction of a large number of town tramways, and various installations for overland lines on the single-phase system, partly for main line working, were taken in hand and partly completed. The favourable working results of the Cologne-Bonn line along the bank of the Rhine, which is equipped with direct-current plant at 1,000 volts, resulted in the receipt of an order for the Berchtesgaden-Landesgreuze-Salzburg railway. The orders received during the year for generators, motors and transformers represented 780,268 KW., as compared with 709,616 KW. in 1905-6. The report, in conclusion, submits that present conditions seem to suggest the prelude to a period of more constant character, although the first four months of the new financial year have again witnessed the receipt of large orders.

The directors of the Siemens & Halske Co., of Berlin, state in their report for 1906-7 that the orders received were largely in excess of the preceding 12 months. During the whole year the works were taxed to the utmost, and the current year has hitherto shown the same rising tendency both in regard to new orders and the degree of employment. The financial position is summarised below for the past two years:—

	1906-7.	1905-6.
Share capital...	£2,725,000	£2,725,000
Loan debt	1,367,000	1,385,000
Gross profits	548,741	515,623
Depreciation provision ...	68,970	74,260
Net profits	435,863	398,236
Dividend, per cent.	11	10

The company's holding in the Siemens-Schuckert Works Co. amounts to £2,252,500, and other permanent investments of a total of £939,000 represent interests held in the Austrian-Siemens-Schuckert Works Co., Siemens Brothers & Co., and the Russian Siemens & Halske Co. and other undertakings. The report mentions that the work of the Cyanide Co., respecting the production of nitrogen of lime as a fertiliser, by the fixation of atmospheric nitrogen is being actively advanced. Presumably a number of foreign companies in which the Cyanide Co. is interested would bring large works into operation in Germany, Norway, France and Switzerland early in 1908. The newly-formed Nitrogen Works Co., of Berlin, would occupy itself with the manufacture of potassium cyanide and other products from nitrogen of lime. The production of steel in electric induction furnaces was making very promising progress, and the business of the Electro-Steel Installations Co., which was formed in conjunction with other interests for the development of this branch, was managed by the Siemens & Halske Co. As far as the glow lamp works are concerned, the report states that during the winter months, in addition to the increased output of carbon filament lamps, it was not possible to meet the considerably higher demand for tantalum lamps. The company almost completed an extension, 1·86 mile long, of the Berlin Elevated and Underground Electric Railway towards Westend, and the construction of the underground section from Potsdamer Platz to the Spittelmarkt was in full swing, whilst the city and suburban line at Hamburg was making progress.

The fifteenth annual report of the Schuckert Electricity Co., of Nuremburg, which deals with the year 1906-7, recalls the increase in the share capital from £2,100,000 to £2,500,000, and the additional payment of £544,500 on the shares in the Continental Company for Electrical Enterprises, in which the Schuckert Co. holds the majority of the shares. The report shows that a further augmentation took place in the profits, to which both the results of the Siemens-Schuckert Works Co. and the various investments and syndicate participations contributed. During the year various securities were disposed of at a profit, and the resulting profit devoted to depreciation and reserve funds. The accounts are briefly as follows:—

	1906-7.	1905-6.
Share capital	£2,500,000	£2,100,000
Loan ,, ...	1,385,000	1,455,000
Gross profits	266,511	212,565
Net ,, ...	194,121	160,206
Dividend, per cent.	5	5

The gross profits given above, which are derived from investments, electrical undertakings owned by the company and from syndicate business, become increased to £314,797 by the addition of the amount brought forward from the preceding year. According to the balance-sheet, the company's principal asset is the share of £2,247,500 held in the Siemens-Schuckert Works Co., a sum which shows no change from the previous year. The debts owing, which are mainly represented by credits granted to subsidiary companies, amount to £850,000, as compared with £798,000 in 1905-6, whilst the creditors are entered at £813,000, as against £646,000 in the previous year. The report gives particulars of the many undertakings in which the company is interested, including the additions made during the past year.

THE REDUCTION OF SLOT OPENINGS BY MEANS OF IRON BRIDGE-PIECES.

OPEN slots are employed in practically all direct-current machines (excluding sizes below 1 H.P.), as also in most alternators and in some induction motors. Their use is desirable from the point of view of easy construction with machine-wound coils, but there is practically no case in which it would not be an advantage to be able partially or

FIG. 1.

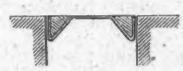


FIG. 2.

FIG. 3.

completely to close the slots with magnetic material after the insertion of the winding. Open slots always add to the magnetic resistance of the air-gap, and in cases where, from constructional reasons, the pole shoes cannot be laminated, the open slots add to the eddy-current and hysteresis losses in the machine. Many attempts have been made to avoid these objections, and Dr. R. Goldschmidt, in a recent article in the *E.T.Z.*, describes some interesting experiments carried out by him in 1903 at Messrs. Crompton & Co.'s

FIG. 4.

FIG. 5.

works with a view to enabling unlaminated pole-pieces to be used in conjunction with economical wide-open slots and small air-gaps.

In order to avoid the risk of eddy currents, the first experiments were made with bundles of fine iron wires packed in paper and placed in the tops of the slots, as shown in fig. 1. These had comparatively little effect—probably because of the small contact area between neighbouring wires. It was also found that the wires were liable to work out of the slots endways after the machine had been at work for some time. Next, solid iron strips of three-cornered section were tried, as shown in fig. 2. With a length of side of about ·2 in. these gave favourable results. Equally good results were also obtained with strips of thin sheet-iron bent at right angles, as in fig. 3 or 4, and finally the arrangement took the form of plain straight strips of sheet-iron ·02 in. to ·04 in. thick, as shown in fig. 5. This last form of bridge occupies an extremely small space. The bridge piece must be insulated from the rest of the armature iron, but at the same time the air-gap between the edge of the strip and the side of the slot must be kept as small as possible. Thin pressspahn or paper is very suitable for this purpose if the necessary care is taken in placing the slips in position.

Many thousands of machines have been made with the arrangement of fig. 5, and the method is still in successful use. The effect of the iron bridge is, obviously, to alter the flux distribution from approximately that shown in fig. 6 to

something like fig. 7, and so to increase the uniformity of flux density over the pole face. Experiment has shown that the iron losses are no smaller with open slots and laminated poles than with the bridged slot and solid poles, even in

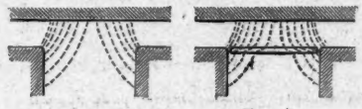


Fig. 6. Fig. 7.

cases where the iron strip was only ·02 in. thick and the slot width as much as ·56 in. Fig. 8 shows the no-load losses in a 60-H.P. motor for 440 volts, 800 R.P.M., having an armature 15 in. in diameter, with 35 slots ·56 in. inside

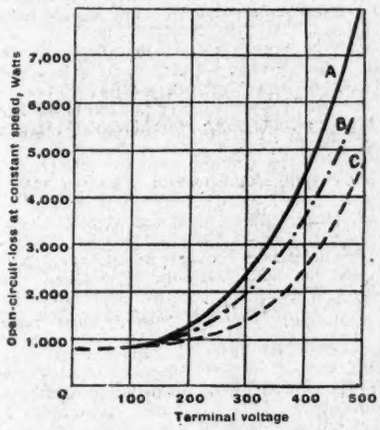


Fig. 8.

and an air-gap of ·16 in., A with solid poles and open slots, B with sol d poles and wire bridges as in fig. 1, consisting of 78 iron wires ·018 in. diameter, C either with solid poles and the bridge arrangements of figs. 2, 4 or 5, or with laminated poles and open slots.

Fig. 9 shows the improvement in air-gap reluctance effected in the same motor. (Curve A represents the result with open slots, and either solid or laminated poles, and

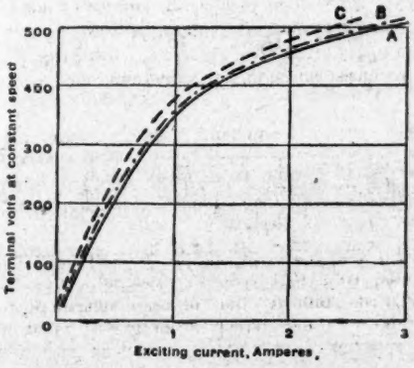


Fig. 9.

curve C that with the bridge pieces of figs. 2, 4 or 5.) The presence of the iron bridges was found to have no influence on the commutation of the machine so long as the bridges did not exceed ·03 or ·04 in. in thickness. This is probably due to the fact that the bridge pieces in the commutation zone are highly saturated by the magnetic leakage from pole to pole, as shown in fig. 10. Thus, fig. 11 shows the "commutation curve" of the above 60-H.P. motor, with and without the bridge pieces. It will be seen that the limit of sparkless commutation was about 97 amperes in each case.

The results of six-hour full-load temperature tests with and without the bridge pieces, and with the full voltage across the magnet windings in both cases, were as follows :—

		Without bridges. A.	With bridges. C.
Temperature rise in armature		40° C.	29° C.
" " field coils		45	32
" " commutator		20	16·5
" " Magnet iron	behind a pole / on the yoke	42	18
	midway between / two poles.	29	18

The author gives similar test results for a 2-H.P. 1,250-R.P.M. motor having slots ·34 in. wide, and an air-gap of ·08 in. The no-load losses were 510 watts with open slots and solid

Fig. 10.

poles, whilst with solid poles and slots bridged as in fig. 5 the loss was only 230 watts at the same voltage and speed.

From further experiments carried out by him at the British Westinghouse Works, Manchester, the author concludes that induction motors with open slots can also be considerably improved, especially as regards overload capacity, by the use of such iron bridges. Thus a 75-H.P. 400-volt induction motor with open stator slots (A) and bridged stator slots as in fig. 5 (B) gave the following test results :—

	A.	B.
No-load current	15	12·4 amperes.
Short-circuit current	480	425 "
No-load current / Short-circuit current	·0312	·0292

The iron losses were approximately alike with and without the bridges.

The fixing of the iron strips in the stator slots is, however, not so simple as in the case of direct-current armatures.

In the case of direct-current machines fitted with compensating windings in slots in the pole faces, the bridging

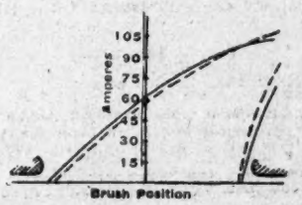


Fig. 11.

of at least one of the sets of slots (armature or field) would be especially advantageous.

The use of the bridge pieces has also been found effective in stopping the humming noise sometimes given out by machines having open slots.

Gas Engines and Accumulators v. Steam Turbines.

—It may be predicted, says the *Electrical World*, that the use of storage batteries will be greatly increased in the next few years. This prophecy is predicated on the belief entertained by many engineers that the steam turbine marks only a transition period in prime movers which must give way to the internal combustion engine because of the superior economy of the latter. The characteristics of these two prime movers are practically antithetical. The gas engine has no overload capacity; it operates best when delivering a steady amount of power, and is liable to give trouble when worked on light loads. The storage battery affords the required flexibility in respect of variations in the external load while maintaining a constant load on the generating equipment, or as one writer on the subject has phrased it, "the storage battery is the natural consort of the gas engine." There is no question that an extended use of gas engines for driving electric generators will be attended by a correspondingly increased volume of business in storage-battery work.

NEW PATENTS APPLIED FOR, 1908

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

1,288. "Improvements in ignition apparatus for internal combustion engines." R. F. COLLUM. January 20th.

1,322. "Improvements in and connected with boxes for electric wiring." H. W. HANDCOCK, A. H. DYKES and R. T. SMITH. January 20th. (Complete.)

1,333. "Improvements in telephonic receivers." A. H. NICHOLSON. January 20th. (Complete.)

1,344. "Improved process for making electrolytic depositions of chromium." F. SALZER. January 20th. (Date applied for under Sec. 91 of the Act, January 21st, 1907, being date of application in Germany.) (Complete.)

1,399. "Improvements relating to telegraphic apparatus." E. T. PARKER. January 21st.

1,401. "Improvements in the methods of insulating electrical conductors and in the methods of supporting and jointing conductors." H. H. BROWN. January 21st.

1,420. "Improvements relating to the treatment of wood for use in electric batteries and electrolytic cells." THE CHLORIDE ELECTRICAL STORAGE CO., LTD., and B. HEAP. January 21st. (Complete.)

1,427. "Improvements in space telegraphy." L. DE FOREST. January 21st. (Date applied for under Sec. 91 of the Act, January 21st, 1907, being date of application in United States.) (Complete.)

1,431. "Arrangement for producing little damped oscillations for wireless telegraphy." W. P. THOMPSON. (Ges. fur Drahtlose Telegraphie m.b.H., Germany.) January 21st. (Complete.)

1,450. "Improvements relating to the electrical operation of haulage and winding gear and the propulsion of vessels, road vehicles and other bodies." H. A. MAVOR and MAVOR & COULSON, LTD. January 21st.

1,453. "Improvements in gas burners and electrical devices for controlling, igniting and extinguishing the gas from a distance." H. L. DOWNE and TELEPHOS, LTD. January 21st.

1,469. "Improvements in methods of producing coherent conductors of refractory materials." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 21st.

1,470. "Improvements in electric furnaces." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 21st.

1,491. "Improvements in and in the mode of manufacture of electrical resistances." P. S. BROOK and J. A. HIRST. January 22nd.

1,502. "Improvements in electricity meters." G. HOOKHAM and CHAMBERLAIN & HOOKHAM, LTD. January 22nd.

1,503. "Improvements in electricity meters." CHAMBERLAIN & HOOKHAM, LTD., and S. H. HOLDEN. January 22nd.

1,532. "Improvements in apparatus for electric signalling." SIEMENS AND HALSKE AKT. GES. (Date applied for under Sec. 91 of the Act, January 23rd, 1907, being date of application in Germany.) January 22nd. (Complete.)

1,546. "Improvements relating to armature windings for commutator electric machines, especially applicable to high-speed machines." THE PHŒNIX DYNAMO MANUFACTURING CO., LTD., and R. POHL. January 22nd.

1,547. "Improvements in or relating to radio-telegraphy." H. LANGE. (Date applied for under Sec. 91 of the Act, January 22nd, 1907, being date of application in Germany.) January 22nd. (Complete.)

1,596. "Improvements in arc lamps." H. E. MOUL. January 23rd.

1,613. "Improved apparatus for noting down telephone conversations and the like." O. SCHMID. January 23rd. (Complete.)

1,670. "Electric current generating and motive-power machine." W. S. FROST. January 24th.

1,696. "Improvements in means or apparatus for heating by electricity." L. A. FRANK. January 24th.

1,705. "Improvements in and relating to sparking plugs." A. SCHANSCHIEFF. January 24th. (Complete.)

1,709. "Improvements in and relating to collecting rings for dynamo-electric machines." THE BRITISH THOMSON-HOUSTON CO., LTD. (J. E. Noeggarath, United States.) January 24th.

1,734. "Improvements in electric battery sub-stations fed from alternating-current systems." A. M. TAYLOR. January 25th.

1,751. "Improvements in or relating to vehicles propelled by a combination of electrical and mechanical power." W. N. STEWART, E. B. KILLEN and F. HARRIS. January 25th.

1,754. "Improvements relating to the recuperation of electric energy for projectors and the like." A. LEBTOURNE. (Date applied for under Sec. 91 of the Act, February 11th, 1907, being date of application in France.) January 25th. (Complete.)

1,770. "Improvements in dynamo-electric machines." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 25th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool; price, post free, 9d. (in stamps).

1906.

ELECTRIC MOTOR CONTROL APPARATUS. British Thomson-Houston Co. (General Electric Co., United States.) 24,448. November 1st.

AUTOMATIC ELECTRICAL CIRCUIT BREAKERS OF THE LOOSE HANDLE TYPE. W. P. Hamlyn. 27,358. December 1st.

1907.

PACKING FOR THE BRITTLE INSULATING SLEEVES OF ELECTRIC IGNITERS FOR EXPLOSION ENGINES. H. Braun and C. Bockmann, trading as Braun and Bockmann Ges. 17,326. July 29th. (Date applied for under International Convention, March 26th, 1907.)

CAUTERIES. L. de Forest. 17,454. July 30th. (Date applied for under International Convention, March 1st, 1907.)

ELECTRIC SWITCHES. C. E. Hunter and W. H. Warren. 17,707. August 2nd.

ADJUSTABLE ELECTRIC LAMP SHADE HOLDER. E. G. S. Kellond. 21,842. October 3rd.

ELECTRIC TRANSMISSION SYSTEMS. British Thomson-Houston Co. (General Electric Co., United States.) 98. January 1st.

INCANDESCENT ELECTRIC LAMPS. British Thomson-Houston Co. (General Electric Co., United States.) 155. January 3rd.

INCLINED CARBON ARC LAMPS. E. Pearce and S. Walton. 521. January 8th.

OPERATING MECHANISM FOR ELECTRIC SWITCHES AND OTHER PURPOSES. British Thomson-Houston Co. (General Electric Co., United States.) 1,278. January 17th.

ELECTRICAL IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. E. H. Clift. 1,301. January 18th.

PROCESSES OF INSULATING ELECTRIC CONDUCTORS. British Thomson-Houston Co. (General Electric Co., United States.) 4,863. February 21st.

SIGNALLING IN WIRELESS TELEGRAPHY. V. Poulsen. 4,802. February 27th.

ROTATING MEMBERS OF DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. and W. F. Dawson. 8,286. April 9th.

IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. A. Hommel. 22,624. October 14th.

MAGNETIC COMPASS. S. S. Lawrence. 24,792. November 8th.

Telephone Progress on the Continent.—In view of the recent and still active opposition to the introduction of the measured-rate system of charging, the following communication which we have received from Mr. H. Laws Webb will be found of interest:—

There has recently been much discussion of what is known as the measured-rate tariff for telephone service, and a few months ago a statement went the round of the Press to the effect that in Germany, Belgium and France telephone rates for unlimited service were materially lower than those in force in this country. Also there have been efforts to discredit the technical policy of the National Telephone Co. and the Post Office in the important matter of the adoption of the central-battery system of working large telephone exchanges.

I have just returned from a tour on the Continent devoted exclusively—barring one week in the Engadine devoted exclusively to more alluring affairs—to the study of telephone conditions. I visited Antwerp, Brussels, Rotterdam, The Hague, Amsterdam, Hamburg, Berlin, Vienna, Munich and Paris, and in each place conferred with the principal telephone authorities, visited the chief exchanges, and was made fully acquainted with recent progress and future plans, both technical and administrative. Well, everywhere I find that measured rates and central-battery equipment are the order of the day. I talked with perhaps 50 telephone officials, administrators, engineers and executives, ranging from an Under-Secretary of State down to an exchange manager, and among them all, Belgian, Dutch, German, Austrian and French, there was no difference of opinion as to the correctness of the measured-rate tariff for telephone service and as to the efficiency of the central-battery system of working large telephone exchanges.

Practice is following precept with more or less rapidity. Germany, which contains about half the total telephones in use on the Continent, is about to abolish the unlimited rate entirely, and in a short time all telephone subscribers in the German Empire will pay for their service at measured rates. An interesting detail is that in the new German tariff the lowest rate at which calls will be sold to the large user is exactly the same as the corresponding figure in the National Telephone Co.'s tariff, viz., 4d. per call. Austria abolished unlimited rates last year, and all Austrian telephone subscribers now pay measured rates. There was much opposition to the new tariff at first, especially from the large users in Vienna, but common sense has prevailed, and the Austrian Administration is now enjoying a rapid increase of subscribers, particularly among private houses and small users generally, owing to the much more elastic tariff which the measured-rate scheme provides.

In Belgium a measured-rate tariff is under discussion, and the responsible Minister has announced that a new scale of telephone rates will shortly be introduced. In France the leading officials of the Telegraph Department have long been convinced of the correctness of the measured-rate principle, and a committee is about to be appointed to prepare a new tariff.

Therefore, whereas it has recently been represented in the British Press that telephone service is supplied in the principal Continental countries at absurdly low figures for unlimited service, the facts are that measured rates are either actually in force or about to be adopted. And when a change of this sort is made by a Government Administration on the Continent, it is not done in the gradual and genial way adopted here by the National Telephone Co. and the Post Office, who allow old subscribers to retain their existing arrangements until convinced of the superiority of newer methods. The Continental subscriber finds his contract changed for him, whether he likes it or not.

As with measured rates, so with the central-battery system. This would hardly be worth mention were it not for the efforts of those connected with the defunct municipal telephone movement to discredit modern telephone work, for among serious telephone engineers there is no difference of opinion as to the superior efficiency of central-battery working. Everywhere on the Continent new central-battery exchanges are coming into use, and old local battery systems are being abandoned and replaced by central-battery plants. The reconstruction of the Berlin system with central battery plant for 100,000 lines is nearly complete, similar work at Hamburg is in course of execution, while many of the smaller systems in Germany have already been converted. In Belgium, Holland and Austria new exchanges are all central-battery, and old ones are gradually being rebuilt on the same lines, while the French Administration is now engaged in converting the entire Paris system to central-battery working.